GEOLOGICAL SURVEY

—OF—

ALABAMA.

REPORT OF PROGRESS FOR 1874.

BY
EUGENE A. SMITH, PH. D.,
STATE GEOLOGIST.

MONTGOMERY, ALABAMA:
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1875.

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NOTE.—The author not having had an opportunity of revising the proof sheets, the indulgence of the reader is craved for any typographical errors that may occur in this Report.

EUGENE A. SMITH, PH. D.,
Sta[illegible]

WITH THE COMPLIMENTS OF
EUGENE A. SMITH,
State Geologist,
University of Alabama.

Exchanges are respectfully solicited.

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To His Excellency,

GEORGE S. HOUSTON,

Governor of Alabama:

SIR—The Report of Progress of the Geological Survey for the year 1874 is herewith respectfully submitted.

I have withheld the report until thus late in the session of the General Assembly in order that a number of chemical analyses, by which its value would be increased, might be made and presented with it.

I have the honor to be, sir,

Your obedient servant,

EUGENE A. SMITH,

State Geologist.

University of Alabama,

January 12, 1875.

PREFACE.

The following report embodies the results attained by the Geological Survey during the past year. In studying the geology of the State, I have thought it best to take up successfully, beginning with the oldest, the geological formations represented; to examine each in as much detail as possible, and to proceed in this manner until the geological relations of the entire State had been thoroughly explored. With this end in view, the time at my disposal for field work during the past summer has been spent in the Archæan or Metamorphic region of the State.

With no provision made for the employment of assistants, it needs hardly to be remarked that the time required to accomplish the work proposed will be considerable. I take great pleasure, however, in stating that Prof. WM. C. STUBBS, of the Agricultural and Mechanical College, has offered his services to the survey. Several analyses by him accompany the present report.

By the terms of the law providing for the revival and completion of the Geological Survey, it is made the duty of the State Geologist, besides the annual reports of progress, to prepare a final report of all the work accomplished.

The following is an outline of the plan proposed for this final report:

Part I. Physical Geography.

Part II. Geology and Paleontology.

Part III. Economic Geology.

Part IV. Agricultural Relations.

Part V. Botany and Zoology.

Much of the material for this report will appear, from time to time, in the annual reports; some of it, however, will be more properly reserved for the final volume.

The valuable collections of fossils made by Prof. Tuomey, to which additions have been made by myself, contain many species new to science, and it is to be hoped that the General Assembly will provide for the publication and descriptions of these interesting organic remains in a style commensurate with their importance. The significance and value of fossils, to a student of geology, are now so generally recognized as to require little mention here. I need only say that they lie at the very basis of all geological classification.

The collection of typical soils and subsoils is a part of the regular field-work of the survey, and analyses and discussions of these and their fitness for the production of the various crops, and analyses of our marls, showing their value for agricultural purposes, will be prominent features in future reports.

I have already collected specimens of a majority of the plants growing without cultivation in Alabama. This list I hope to make nearly complete for publication in the final report.

Information concerning the animals indigenous to our State is also desired, that the history of these may be presented at the same time. The natural history of the in-

sects injurious to vegetation, and of the birds and animals which prey upon them, is of the most direct interest to the planter. There is very little doubt that a careful study of the habits of the cotton moth and caterpillar, by a skilled entomologist, will lead to the detection of some means for exterminating this pest.

I have wished to present with this report the statistics, in tabulated form, of the iron industry of Alabama. Only four of the companies have as yet responded to my request for information ; the list, therefore, is incomplete.

Geological Map.—Separate maps of the counties, so colored as to show the geological formations, are in course of preparation. These maps will be preliminary to the construction of a general geological map for the State.

In the nature of things, a geological survey can never be *completed.* Fresh developments are constantly being made. "Facts now entirely hidden from our view will be revealed by mines, wells and railroads." *At best,* a geological survey can be said to be completed only when all the facts bearing upon the geology of the area, *at the time available,* have been collected and co-ordinated. To do this, as much time and patient examination would be required for each county as are generally devoted to the survey of an entire State.

To those who may find an objection to this report, in the meagreness of its details, I can only say that the time and means at my disposal for the prosecution of the work have both been limited.

Finally, I have to acknowledge my obligations to the authorities of the South and North Alabama, the Alabama and Chattanooga, and the Selma, Rome and Dalton Railroads, for courtesies, by which the expenses of the Survey have been materially lessened.

To Mr. F. S. Wadsworth, Engineer South and North Alabama Railroad; to President Alexander, of the Savannah and Memphis Railroad; and to Col. R. A. Hardaway, of the Agricultural College, I owe the profiles of the roads given in Appendix B.

To the Rev. C. D. Smith, of Franklin, N. C., I am indebted for the account of the Corundum of Tallapoosa county.

It would be impossible to enumerate the instances in which I have received important assistance in the prosecution of the field-work, and the acts of kindness and courtesy which have uniformly been extended to me. For all such courtesies I return my grateful acknowledgments.

EUGENE A. SMITH.

University of Alabama,
January 12, 1874.

HISTORICAL SKETCH.

The first systematic examination into the geological structure of the State of Alabama, was begun in 1847 by Michael Tuomey, then Professor of Mineralogy, Geology, and Agricultural Chemistry, in the University of Alabama.

It was made the duty of that officer, at his appointment, "to spend such portions of his time, not exceeding *four months* in each year, in exploring the State in connection with his proper department, as the trustees may consider for the advantage of the State."

Reports of this survey were made to the board of trustees, and extracts from the same, which were thought to be of general interest, were published in the Tuskaloosa newspapers.

The interest excited by these published extracts, led to the passage by the general assembly of the State, in January, 1848, of resolutions appointing Professor Tuomey Geologist to the State, and requiring him to lay before the general assembly the full reports of his geological surveys and explorations.

The expenses of these explorations were borne by the University, and the report upon them was submitted to Governor Collier, in December, 1849, which report was published at the cost of the State in 1850.

Professor Tuomey continued his explorations, the University of Alabama still bearing the expenses of the survey, until the passage by the general assembly, in 1854, of "An act to provide for a geological and agricultural survey of the State," by which the Governor was authorized to appoint a State Geologist, and the sum of ten thousand dollars, exclusive of the salary of the State Geologist, was

appropriated for the purpose of employing assistants and defraying the incidental expenses of the survey.

Professor Tuomey received the appointment of State Geologist, and early in 1854 took the field, in company with E. Q. Thornton, Esq., his assistant. Other assistants in field work, were Oscar M. Lieber, Esq., and W. Echols Hollowell, Esq., and in January, 1855, Dr. John W. Mallet was appointed Chemist to the survey.

In the autumn of 1855, the second biennial report was submitted to the legislature, and ordered to be printed. The printing of the report was delayed from various causes: Professor Tuomey's death occurred in March, 1857, and upon Prof. Mallet devolved the duty of superintending the publication of the report, which appeared in 1858.

Since the termination of the war, the attention both of Alabamians, and of citizens of other States, has been directed to the vast wealth of our natural resources. The development of this hidden wealth was naturally looked to as one of the most important features in the problem of the restoration of the prosperity of the State. The changes in the system of labor, and in the relations of the laborer to the land-owner, consequent upon the decisions of the war, lessened very materially the profits of agriculture, which, until 1865, and even a few years later, was almost the only great industry within the limits of the State.

Before our citizens had learned to adapt themselves to the new order of things, many a disastrous failure had fallen upon them. Discouraged by these repeated failures, many have looked for other fields in which to invest more profitably their labor and capital. The immense coal and iron deposits of Alabama could not long escape notice, and demands for the two Geological Reports of Prof. Tuomey were continually made by men desirous of investing in the iron and coal lands. These reports have for some years been very scarce, and I believe are not now to be had. Attempts have been made to induce the general assembly to re-publish them; but without success. Many private surveys have been made by companies; but the reports of

such explorations have not been always at the service of the people.

Under these circumstances, it will not excite surprise that the Board of Regents of the University, at their meeting in June, 1871, passed an ordinance requiring the Professor of Mineralogy and Geology in the University to devote as much time in travelling through the State, in making collections and examinations in Geology, as was consistent with his duties at the University.

Under this ordinance, some time was spent by me in the field, and at the meeting of the legislature in 1872–3 the following bill was introduced in the House by Hon. N. H. Brown, representative from Tuskaloosa county; which bill was subsequently passed by both houses, and was approved by the Governor April 18th, 1873:

AN ACT

To revive and complete the Geological and Agricultural Survey of the State of Alabama.

"Whereas, by an act of the General Assembly approved January, 1848, and an act approved January 3d, 1854, a geological and agricultural survey was instituted and prosecuted for some years, with great advantage to the people of the State; and

"Whereas, the said survey was left incomplete by the death of Prof. Michael Tuomey, State Geologist; and

"Whereas, Dr. Eugene A. Smith, Professor of Mineralogy and Geology in the University of Alabama, is required by ordinance of the Board of Regents of said University to devote a portion of his time and labor to a geological exploration of the Sate, and to an examination of its mineral and agricultural resources; therefore,

"Section 1. Be it enacted by the General Assembly of Alabama, That Eugene A. Smith, Professor of Mineralogy and Geology in the University of Alabama, be and he is hereby appointed State Geologist.

"Sec. 2. Be it further enacted, That the said State Geologist shall make to the Governor an annual report of the

progress of his surveys and explorations of the mineral, agricultural, and other natural resources of the State; and upon the completion of the survey he shall make a full report of his labors, including surveys and explorations of mineral deposits, their location, and the best and most economical methods of development; of the qualities of soils, and their adaptation to agricultural purposes, together with analyses of soils, ores, minerals and mineral water, with maps, charts and drawings; which said report shall be printed, and shall be the exclusive property of the State.

"Sec. 3. Be it further enacted, That it shall be the duty of the said State Geologist to make collections of specimens, illustrative of the geological, agricultural and mineral features of the State, one suite of which shall be deposited in the cabinet of the University of Alabama, a second suit in the cabinet of the Agricultural and Mechanical College, and a third in the office of the Commissioner of Industrial Resources, in the State capitol at Montgomery.

"Sec. 4. Be it further enacted, That for the outfit of the said survey, there shall be appropriated out of any moneys in the treasury not otherwise appropriated, first, the sum of eight hundred dollars ($800) for the purchase of chemicals and the necessary apparatus of a laboratory for the analysis of soils, ores, minerals and mineral waters; second, the sum of two thousand two hundred dollars ($2,200) for the purchase of an ambulance and team, and other equipments; third, an annual sum of five hundred dollars ($500) to pay the travelling and incidental expenses of the said State Geologist during such time as he is engaged in the field work of the survey. The Auditor shall, on the requisition of the said State Geologist, when approved by the Governor, draw his warrant on the treasury for the said sums as they shall be needed for the purpose of said survey as herein set forth; and the vouchers of said State Geologist, for all expenditures made from this fund, shall be filed with the Auditor, to be laid before the general assembly. Approved April 18, 1873.

"Official: Pat. Ragland, Sec'y of State."

It may excite surprise that a State so rich in mineral wealth as is Alabama, should make so meagre a provision for the explorations necessary for its development. But those who have known the financial difficulties that have embarrassed the State for several years past, can appreciate the desire of legislators to economize whenever possible. It may questioned, however, whether a true economy would not have provided for the immediate and rapid examination of the geological relations of the State, and, by putting a large force into the field, have completed the work within a few years, and have given to the people so much earlier the advantages of the information thus acquired.

I.

ARCHÆAN FORMATIONS.

The counties of Chilton, Talladega, Calhoun, Cleburne, Lee, Tallapoosa and Elmore lie partly, and Coosa, Clay, Randolph and Chambers wholly, within the Archæan region of the State.

1. Subdivisions.

The archaean rocks include the true azoic rocks, though it is not possible to define strictly the azoic areas. The presence of graphite, &c., in the most crystalline and apparently the oldest rocks of this formation, is generally admitted to be a proof that some form of life existed at the time of their formation. Upon this ground, therefore, I have not adopted the name *azoic* for any of these subdivisions.

In the absence of fossils, the determination of the relative ages of the subdivisions of the crystalline rocks, is a difficult problem, and the difficulty is greatly increased by the occurrence of faults, by which the older rocks are lifted up and brought into juxtaposition with others undoubtedly more recent.

A classification of the crystalline schists upon *lithological* grounds, has been made, and it is the one here followed, provisionally at least, until a better one shall be devised.

1. *Laurentian.*—In the norite or hypersthene rock in the vicinity of Columbus, Ga., we have probably a representative of the upper Laurentian or Norian. I do not feel sure that any of the gneisses and hornblendic gneisses enumerated below, belong here.

2. *Huronian.*—This subdivision in Alabama, is represented by a series of stealites, chloritic rocks, associated with corundum, hydro-mica slates, quartzites and argillites,

the latter often plumbaginous. Some of these belong to the Taconic system of Emmons. The most important of the gold bearing rocks of Alabama may be referred to this period.

3. *White Mountain Series.*—To this series as defined by Prof. T. Sterry Hunt, I have referred the mica schists with garnets, cyanite and graphite; in which beds or veins of coarse-grained granite are so often found: hornblendic gneisses, fine grained mica slates, micaceous quartzites and crystalline limestones, which together form several well defined belts in our metamorphic area.

The rocks of this series have sometimes been considered as Laurentian. The copper bearing strata of Cleburne county, and south-westward, are here included.

2. Kinds of Rocks.

In the sequel I have used the term *schist* to denote the coarser grained rocks, with evident crystals, whilst the fine grained crypto-crystalline varieties have been termed *slates.* There is, of course, no absolute line of distinction to be drawn here.

The rocks of this region are, with few exceptions, *crystalline,* i. e. "the grains, when large enough to be visible, are crystalline grains, and not water-worn particles or fragments of other rocks." Another character of the greater part of them is, that they are *stratified,* or disposed in parallel beds or layers. The name *crystalline schists,* is frequently given to rocks which show these peculiarities. They are sometimes also called *metamorphic rocks,* because they were originally deposited as sedimentary beds of mud, clay, sand, &c., which have subsequently been *altered* or *metamorphosed* into gneiss, mica-schist, &c., by long continued exposure to heat.

Following Dana's classification, I shall consider the rocks of this formation under the following heads:

1. *Mica-bearing Series.*

1. Granite.—A massive, granular rock, composed of feldspar, quartz and mica. Generally both white and

black mica are present, and a triclinic feldspar (oligoclase) is often associated with the orthoclase. Typical granites may be seen in Coosa county, near Bradford, Randolph, Clay and Chambers. The texture varies from fine grained to very coarse grained. Veins or irregular masses of a coarse grained granite or *pegneatite*, are frequently met with, in connection with mica schists, in Chilton, Coosa, Clay, Randolph, &c. From such veins some, at least, of the large plates of mica are obtained.

2. Gneiss.—Of the same composition as granite, but showing a distinctly laminated or schistose structure, from the parallel arrangement of the mica. Gnëiss is thus, in some sense, a stratified or schistose granite. Transitions from granite into gneiss are to be seen with many, if not most, of the granite exposures in this State. Gneiss with the typical constitution of quartz, feldspar and mica, is not one of the most common rocks of this formation in Alabama, a variety containing a proportion of hornblende, being much more widely distributed. This hornblendic or syenitic gneiss will be considered in another place.

3. Mica Schist.—Like granite, and gneiss, composed of quartz, feldspar and mica, but with less feldspar, more quartz, and much more mica. It breaks readily in one direction into thin slabs; the schistose or laminated structure, due to the parallel arrangement of the constituent minerals. Of wide distribution in our metamorphic regions.

The majority of our mica schists abound in red garnets, usually small, but sometimes one to two inches in diameter.

Crystals of tourmaline, generally associated with quartz, are found in many localities amongst these schists. Cyanite is also found in Chilton, Clay, Cleburne, &c., with mica schist. An interesting association of cyanite, graphite, and a hydrous mica (Damourite?), occurs in Clay county. In many places the mica schist is much decomposed, soft, friable, of reddish or purplish colors: the mica is frequently soft, of greasy feel, like some hydrous micas.

A schistose rock, composed of quartz and a pearly hydrous mica cutting like talc—but showing strong reactions for alumina, in which graphite in small scales, and occasionally large masses, is disseminated, may possibly belong here. Such is the rock, usually called talcose mica schist, in which the graphite of Chilton county is found. In no instance, however, have I found any talc in this rock.

Allied to this is a friable, arenaceous schist, of grayish, ashy color, with a greenish, hydrous mica and few scales of graphite, which in many places is intimately associated with a peculiar gossau made up of shells of brown and red iron ore, although it is also found with other associations.

4. Mica Slate.—By this name Prof. Dana designates a rock having the chemical constitution of mica schist, but with smoother surface, the mica not being visible in scales, unless magnified. It is more crystalline than clay slate, into which it graduates.

5. Hydromica Slate.—This is similar to mica slate, but contains a *hydrous* mica, which gives the rock a pearly lustre and more or less greasy feel, like talc. Most, if not all, of what have been called talcose slates, are hydromica slates, containing very little magnesia. The soft, pearly slates which are found in abundance on the north-western boundary of the metamorphic region, belong to this division.

6. Clay Slate or Argillite.—Fine grained slaty rocks, with the composition of mica slate, as above given, into which it passes, through clay mica slate or argillaceous mica slate. A strict line of demarcation cannot well be drawn between the mica slates and argillites. The colors of the latter are gray, greenish, reddish, to black—many varieties contain chlorite. The usual minerals associated with the argillites in our metamorphic regions, are garnets and andalusite. In some places tenticular masses of quartz are enclosed in the layers of slate. In a few localities I have noticed evenly splitting varieties, good *roofing slates.*

As a variety of mica slate or argillite, may be mentioned

a plumbaginous or graphite slate, which is of frequent occurrence in Clay, Coosa, Tallapoosa, Chambers and Randolph, usually not far distant from the granitic belt which runs through those counties.

The best of these are soft, have the greasy feel and black metallic streak peculiar to graphite, and when tolerably pure, are used for lubricating purposes. Other varieties lack the metallic lustre and greasy feel to a great extent—but readily burn white or light gray before the blowpipe.

2. *Hornblendic Series.*

1. SYENITE.—A massive rock of crystalline granular texture, and composed of quartz, feldspar and hornblende, the latter ingredient taking the place of mica. In this respect syenite differs from granite. Quartz is, however, usually less abundant in syenite than in granite. Of true syenite, I know of no occurrence in Alabama. A porphyritic rock, composed of feldspar, hornblende and dark colored mica, mentioned in Lee county, might perhaps be classed here, though from its transition into a laminated rock, it might more properly be referred to.

2. SYENITIC GNEISS.—Which may be defined as a gneiss in which hornblende takes the place of part or all of the mica. This rock is one of the most common throughout the metamorphic region, but especially in its south-eastern part.

In this portion of the metamorphic regions, all the gradations between gneiss, through hornblendic or syenitic gneiss, may be seen.

4. HORNBLENDE SCHIST.—A schistose rock composed chiefly of hornblende, with sometimes a little feldspar, or quartz.

With the above named hornblendic rocks, magnetite and brown iron ores frequently occur. Only one bed of the brown ore, in Clay county, has as yet been utilized. The analysis given of a magnetite from Kennedy's in Clay county, shows that the metamorphic iron ores will bear comparison with those from other formations.

4. Diorite.—Differs from syemite in having a triclinic feldspar instead of orthoclase. Much of the syenitic gneiss contains a triclinic feldspar. I have seen no specimen, however, of true diorite; *i. e.* the massive rock.

5. Norite or Hypersthenite.—A granular crystalline rock, occurring opposite Columbus, Ga., composed chiefly of triclinic feldspar, of yellowish to dark colors, with bright colored internal reflections (labradorite,) and a small proportion of lamillar *hypersthene*, is the only norite that I have yet seen in Alabama. The lighter colored masses of feldspar have a greasy lustre, and show distinct striation on some clearage surfaces.

3. *Hydrous Magnesian Series.*

1. Talcose Slate.—Which is a slaty, soapy feeling rock, composed of talc, or is by no means a common rock in our metamorphic region.

2. Soapstone or Steatite.—A granular, massive or schistose rock, of greenish and grayish colors, soft, soapy to the touch—a hydrous silicate of magnesia. Beds of this rock are common, especially in the region of hornblendic rocks, and most of it is characterized by the presence of small acicular cystals of a variety of hornblende, actinolite or anthophyllite.

With it are usually associated chloritic rocks, especially

3. Chloritic Schist.—A schistose aggregate of scales of dark green chlorite, with some quartz and feldspar.

Chlorite, as an ingredient of argillites, has already been mentioned.

I have little doubt that some of our so-called talcose slates and steatites will be found, upon analysis, to contain more alumina than magnesia, and to approach in composition *parophite* and *pyrophyllite.* In a subsequent report, I hope to present the definite composition of some of the rocks of this interesting class.

4. *Quartzose Rocks.*

1. Quartzite.—A granular to compact quartz rock,

usually of light colors. Feldspar and mica are sometimes disseminated through the mass. It differs from sandstone in the absence of a cement by which the quartz grains are held together; but this difference is not always manifest, especially in the cases of standstones with a siliceous cement. Some quartzites in the north-western part of the metamorphic region, have a porphyritic aspect from segregated masses of quartz, (pebbles?)

The quartzite is often schistose from parallel layers of mica—aud then may more properly be classed with mica-schist, into which it passes by increase of the quantity of mica.

2. Siliceous Slate.—A flinty slaty quartz rock, of apparently compact texture. This is a very common rock in the same region.

3. Itacolumite.--A schistose mixture of quartz grains and a hydrous mica. The quartz grains form the principal part of the mass. The presence of the mica gives some flexibility to some varieties. Fine examples of this rock may be seen at several places in the south-eastern part of the region under consideration. Of associated minerals may be mentioned gold, diamond, specular iron. Of these the Alabama itacolumites show, so far as I am aware, only the latter.

Sometimes the specular iron is disseminated in larger or smaller masses—in a schistose aggregate of white quartz, white mica, and a hydrous mica—the quartz being, however, the principal ingredient—forming a *specular schist* or more probably,

4. Itabirite, since the iron mineral is not always hematite. The best examples of this variety occur in Clay county.

5. Jasper Rock.—A compact siliceous rock of dull colors, usually red, yellow, or greenish—breaking with smooth surface. Fine examples may be seen of this rock in Lee and Macon counties.

Calcareous Rocks.

1. Crystalline Limestone.—(*Granular Limestone*, marble.) Essentially carbonate of lime, white or gray in color, usually with some impurities, as talc, mica, &c. Occurs in Talladega, and other counties, on the north-western edge of metamorphic region.

2. Dolomite.—A crystalline granular rock, composed of carbonate of lime and carbonate of magnesia. The limestones of Lee county belong here.

Igneous Rocks.

These rocks, though of frequent occurrence, especially in the south-eastern part of the metamorphic region, have been very little studied. A fuller consideration of them will accompany a subsequent report.

3. General Distribution of the Archæan Strata.

A general idea of these strata may, perhaps, best be given in a geological section approximately at right angles to the strike, from near Talladega to Dudleyville in Tallapoosa county, and thence by Opelika to Columbus, Ga.

On the south-eastern border of the silurian formation in Alabama, from the Georgia line to the northeast corner of Chilton county, a stratum of crystalline limestone, almost pure carbonate of lime, may be traced by its occasional exposures. This has usually been considered as the limit of the metamorphic rocks towards the silurian. Succeeding this limestone and *apparently* overlying it conformably (the true stratigraphical position may be obscured by a fault,) is a series of semi-metamorphic strata between 15,000 and 20,000 feet in thickness, striking northeast and southwest, and dipping at high angles (45 degrees) southeast. This series beginning below, is composed of greenish gray hydro-mica slates, (talcoid slates, nacreous argillites, talcose slates,) passing upwards into a conglomerate by enclosing lumps of quartz; these slates are succeeded by thick beds of quartzite, alternating with greenish chloritic schists. The quartzite in places is a thin bedded sili-

ceous slate, again, a thick bedded quartzose conglomerate' and still again a laminated quartzose or onenaceous rock, not very coherent, and enclosing small grains of quartz. This series of quartzites in their several varieties, makes up the main body of the Blue Mountain range in Alabama. This mountain range is a dividing ridge almost its entire length, only Talladega creek rises southeast of it and cuts through it.

Towards the southeast the quartzites and conglomerates are succeeded by various slates, interstratified with thin beds of quartz. Of these slates, some are argillites, affording very good roofing slates, but the majority are greenish and grayish chloritic and aluminous slates.

These strata are the probable equivalents in Alabama of the Ocoee conglomerates and slates of Prof. Safford, of the Tennessee survey, by him referred to the Silurian age underlying the Potsdam. By Prof. Sterry Hunt the entire system of crystalline schists has been referred to pre-Silurian and pre-Cambrian age. My own observations in the field, whilst inclining me to the latter view, have not been sufficiently extended to enable me to form an independent judgment on this point. In disturbed areas with numerous faults like this, the evidence of superposition is often misleading, and without fossils the question of age is not easily settled. Mr. F. H. Bradley refers to the lower Silurian all the metamorphic rocks of North Carolina as far east as Franklin.

Lithologically, these belong to the 2d subdivision above, or Huronian. They all dip about 45 degrees to southeast.

As in Tennessee, so in Alabama, the greater part of the auriferous quartz veins and deposits, are to be found in this series, though important gold deposits are not infrequent in the next series.

Succeeding these semi-metamorphic strata, towards the utheast, is a tolerably well characterized series of crystalline schists, consisting of mica schists holding garnets, interstratified with gneisses which sometimes pass into hornblendic gneiss—the latter rock alternating with garnetifer-

ous mica schist and fine grained mica slates, is characteristic of the north-western portion of this belt. Crystalline masses of cyanite, often associated with a hydrous mica (probably damourists,) and in one place with graphite also, are common. The copper mine in Cleburne county occurs in mica schist, associated with a coarse grained hornblendic gneiss.

Many of the rocks under consideration have undergone a thorough decomposition in place, by which they have been converted into ferruginous stratified clays, in which the unaltered beds of quartz are prominent.

A stratum of hornblende rock, associated with steatite and large crystals of chlorite has been noticed within this area—apparently a local occurrence of the preceding.

Arenaceous schists, with flattened crystals of an iron ore, not yet analyzed, but which has a black streak and very little polarity, occur in this region in Clay county, whilst quartzose and micaceous schists, with numerous scales of graphite, and in one locality with graphite in large irregular masses, are abundant.

A well defined belt of mica schist, with garnets, succeeds the mica schists and hornblendic gneisses just mentioned. The decomposition of this schist and the resulting light purple tinge, are characteristic, as are also the frequent beds or veins of coarse-grained granite, from which large plates of mica have been obtained.

These rocks have the characteristics of the third or White Mountain series.

Following these, a narrow belt of fine-grained mica-slates, and soft, soapy-feeling argillites, often impregnated with graphite, so as to be of use as a lubricating material, probably referable to the second series or Huronian.

Next, towards the south-east, comes mica schists and gneiss, passing into granite, which is exposed at intervals from the mouth of Chestnut Creek, north-eastward by Bradford, Coosa county, and Blake's Ferry into Chambers and Randolph counties. Beyond the granite, gneisses and mica schists, and again in many alternations, make up the second belt of rocks of the third series.

In Coosa county, the granite is intimately associated with gneiss, sometimes hornblendic, and mica schists. In Chambers and Randolph, however, the smooth, broad expanses of granite often appear as isolated masses, at most with a border of gneiss, in the midst of the nearly vertical slates of the Huronian.

Continuing our section, we come next upon fine-grained mica slates and micaceous argillites or hydro-mica slates, the latter often enclosing small lenticular masses of quartz, and gold-bearing quartz veins. These are followed by chloritic schists, with steatite, corundum, and its various associates. The relations of these will be given below in the details of the counties. The characters of the Huronian will be recognized here.

From the beginning of our geological section, up to this point, and for a few miles further towards the south-east, beyond Dudleyville in Tallapoosa county, the prevailing strike of the strata is, with few exceptions, (specially noted elsewhere, so far as observed) north-east and south-west, and the dip south-east, the rocks designated as Huronian being frequently nearly vertical.

A few miles beyond the town named, a synclinal axis is passed, and a few miles further an anticlinal. The strata, hornblendic gneiss, with quartzites, probably of the third series.

A second belt of steatites, with associated chloritic and hornblendic rocks, is crossed in the lower part of Chambers county, whence it extends north-east into Georgia, and south-west to the Tallapoosa river at Coon Creek, a few miles above Tallassee. This soapstone belt makes very nearly a second synclinal, and below it to Opelika, and a few miles beyond, the strata (referred to the White Mountain series) dip northwest. At Chewacla and southwest to Wright's mill (see details of Lee county) another anticlinal is seen in strata of micaceous quartzites, hornblendic gneiss of the same series. At Columbus, the morite or hypersthene rock, which is there associated with mica schist, has been referred, with some doubt, to the upper Laurentian or Norian.

From the facts just enumerated, it will be seen that this area is made up, principally, of alternations of the rocks of the *Huronian*, and of the *White Mountain* series, as defined above.

The term Azoic has frequently been applied to the rocks of the latter series, whilst the Taconic system of Emmons* includes the chloratic and argillaceous slates and quartzites, at least of the former.

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*Objection to the use of the term *Azoic* has already been given. The Taconic system, as defined by Emmons, was a series of fossiliferous sedimentary rocks, underlying and older than the Silurian. The strata to which this name was *originally* given, has been shown by the researches of Dana and others, to be of *Trenton*, or Lower Silurian age. I have, there fore, not thought it advisable to adopt this name.

II. DETAILS OF THE COUNTIES.

CHILTON (formerly Baker) COUNTY.

Topography.—Extending north-west and south-east through the county, is the dividing ridge between the waters of the Waxahatchee, Yellow Leaf, Walnut and Chestnut Creek, flowing into the Coosa, and the tributaries of the Little Cahawba, Big and Little Mulberry, and Swift Creek, which flow into the Alabama. The following altitudes above tide level, of the stations on the South and North Road, will present to the reader the configuration of this county along the railroad line.

Verbena, 350 feet.
Cooper's, 358 feet.
Clanton, 496 feet.
Lomax, 525 feet.
Jemison, 606 feet.
Clear Creek, 440 feet.
Calera, 402 feet.

It is only with the eastern part of the county, bordering on the river, within 10 to 12 miles, that we have to do in this report.

GEOLOGY.

The geological formations represented in Chilton county, are:

1. The Metamorphic, embracing all that part of the county lying between the river and a line beginning about section 17, township 24, range 16, east, and running west to the range line between 14th and 15th; thence south to Clanton, and following the line of the railroad to Verbena, which is near the line of Autauga.

2. A small portion of the northern part of the county is underlaid by Silurian Rocks, but the greater part of it is covered.

3. By the same beds and pebbles of the Modified Drift.

The description of the Silurian and Drift formations will be reserved for a subsequent report.

Near Verbena, west of the railroad, angular fragments of quartz and syenitic gneiss may be seen with the rounded pebbles of the Drift, showing the approach to the metamorphic region. Where the railroad cuts are deep enough the surface covering is passed through, and layers of micaceous sandstone are exposed. Above this sandstone are beds of pebbles, very irregular in shape, and apparently with very little traces of stratification. The sand enclosing these pebbles is of that deep red color, seen so frequently in the neighborhood of limestone strata. Angular fragments of quartz and other rocks make up a considerable part of these pebbles. About half a mile northeast of the station is a Chalybeatė spring on the land of Maj. Gibson.

In the bed of the creek, just below Pinson's mill, strata of syenitic gniess are well exposed.

From the station, Chestnut creek flows in an easterly direction for about three miles, and then north of east to the river. It thus cuts through the strata of the rocks which strike north-east and south-west. The rock thus cut is chiefly a mica schist, with a hydrous mica. About three miles east of Verbena, in section 33, township 21, range 16, at a locality called the Turn Around, the creek is deflected from its course by a high ridge of this schist, and after making a circuit of the ridge, of a mile or more, it returns on the other side ; the two parts of the creek separated by this high ridge being only about fifty yards apart. On the narrowest part of this ridge, a curious effect of denudation may be seen in a sort of natural bridge, which spans a fissure in the rocks. In section 35 of the same township and range, on land belonging to Mr. Sam Dennis, some excavations have been made, I believe, in search of copper. The rock is principally a mica schist,

which assumes a purplish tinge on decomposition, due to iron present. This rock is frequently interstratified with layers of quartz, which are in places coated with a thin iridescent film. This iridescence is almost universally looked upon as due to copper, but is nothing more than the colors due to a thin film of hydrated ferric oxide. But of more interest than these iridescent colors are lumps of pure *graphite* of the size of the first, and smaller, which have been thrown out in excavating the pit. There was no way of getting a fair exposure of this graphite-bearing schist, the old pit being partly filled up; but I saw very good pieces of graphite in the pile of rubbish at the mouth of the pit, as well as in the strata cut through. The graphite seems to form nests and irregular masses in the rock. This occurrence is of the highest interest, for although graphite is found in various parts of the State, desseminated in small scales in other rocks, I know of no other locality where it is to be found in masses. Much of what is called graphite in Alabama is nothing but a black carbonaceous or graphitic slate, which answers for lubricating purposes tolerably well. Occurrences of this slate will be noticed in the descriptions of the geology of Clay, Randolph and some other counties where it is found.

In section 3, township 20, range 16, about two miles from Mr. Dennis', I found many loose crystals and pieces of Rutile, and a few crystals imbedded in quartz. These crystals showed the combinations of the two prisms with the two pyramids—1, 1i, I. and ii ; occasionally the pyramidal termination was noticed at both ends. The rock which enclosed them is the same mica schist mentioned above; and near this place masses of large crystals of mica were noticed. Some of the quartz interstratified with this schist was coated with an irredescent film, and enclosed in places considerable quantities of pulverulent ferric oxide. This substance has been used as a paint, and as a die, for which it answers well.

In section 32, township 21, range 16 east, some work has been done in search of copper; the rock is chiefly a hard

greenish (chloritic) (?) schist; the indications upon the surface, which have led to the belief that copper is to be found below, are masses of porous brown iron ore resembling the so-called "gossan" of the copper mines. Seams of quartz having the iridescent tarnish just mentioned are found also associated with the above named rocks. With the ferruginous tufa at this place is a light grayish arenaceous schist, very friable. This rock is full of little scales of graphite, and the occurrence is identical with that to be noticed on the land of Mr. Thomas Lambert, in Coosa county. The graphite is not confined to this friable schist alone, but is found also in a dark clayey slate, lending it a peculiar character.

The syenitic gneiss seen at Pinson's mill, near Verbena, strikes north-east towards the river, and in section 16, township 21, range 16 east, are the old Ripito gold mines; other mines occur several miles further south. These mines are on Blue creek, near the line of the syenitic gneiss. The surface deposits only are worked. At the present time only a few men are engaged at these mines. On Blue creek, near Mr. James' mines, may be seen the remains of an old structure, supposed to be an Indian fort. The walls are constructed of fragments of syenitic gneiss, the country rock. Trees several feet in diameter are growing upon the ruined walls. Northward from Blue creek is crossed a belt of mica schist, frequently holding garnets, extending to Walnut creek, or a few miles beyond —a distance of six to eight miles. This rock is very much decomposed; the prevailing color, not only of its outcrops, but also of the soil derived from it, is a light purple. The country is much broken, and the roads are very tortuous, following the crests of the high ridges. Upon these hills the vegetation is of the scantiest kind—stunted pine trees and a few hardy plants alone being able to derive subsistence from the barren soil. Of frequent occurrence are rock masses composed of large plates of mica and coarse fragments of quartz. These masses are usually very porous, and probably are remnants of a coarse-grained gran-

itic vein from which the feldspar has been weathered. The garnets inclosed in this mica schist are likewise much decomposed, in some places only the moulds remain from which the garnets have been removed by decomposition. Nowhere in this region did I see any rock in a comparatively fresh state; even where fragments had been brought up by the roots of fallen trees, the same indications of a thorough, deep disintegration were noticed. Cyanite is a common mineral with this rock. Crossing Walnut creek, however, the mica schist ceases to be the prevailing rock, though occasional narrow belts of it are seen, interstratified with the more abundant quartz, and argillaceous schists.

In the region between the mouth of Walnut creek, in section 20, township 22, range 16 east, and Mr. J. S. Welden's, section 2, township 22, range 15 east, are several outcrops of a coarse-grained granite rock, of some interest on account of the handsome plates of mica obtained from it. One mine is in section 20, township 22, range 16 east, another in section 23, township 22, range 15 east, about three miles northwest, a direction nearly at right angles with the strike of the friable mica schist in which the rock occurs. The exact relations of these outcrops to the enclosing schist were not easily made out, though they are probably parts of a granite vein, left exposed by the wearing down of the softer rocks adjacent. The exposed masses are principally aggregations of quartz and mica, the plates of the latter showing no approach to parallelism, either with each other or with the bedding planes of the adjacent rocks.

Large rounded masses of interwoven mica crystals, the "boulders" of the workmen, furnish the material. These "boulders" are split up—the mica plates cut to the required sizes and shipped to the market. There is considerable waste, since a large "boulder" will yield comparatively few plates large enough to be preserved.

As these mines have been worked but two or three weeks, they are not yet properly developed, and only a few of the crystals are free from traces of weathering; as

the depth below the surface increases, it is probable that fresher and more valuable mica will be reached.

Of associated minerals, I have seen only flattened crystals of tourmaline enclosed betwen the plates of mica; these are quite common.

The discovery of valuable mica in this county, and the first attempts to bring it into the market, are due to the indefatigable zeal of Col. James George, of Clanton.

Of the numerous strata of quartzite interbedded with the other rocks, a remarkable variety occurs in section 7, township 22, range 16 east, at the sand rock quarry. Here the rock is exposed over a small area, in beds striking north-east and south-west, and dipping south-east about forty-five degrees. Part of the rock is a quartzite of a pine-white color, very hard and compact; another part is quite soft and friable, perfectly white, and can be crumbled between the fingers into a white, sharp sand of quartz crystals. Over some part of the exposure, this curious rock is mottled with stains of iron. For the manufacture of glass, I know of no more suitable material in the State than the white, friable variety. It is perfectly free from all impurities, and consists of aggregated crystals of quartz.

Continuing on a north-west course, the mica schists are succeeded by argillites of dark greenish colors, then soft, dark micaceous schists, without quartz, generally much decomposed and stained with iron. Masses of cyanite, covered with a bluish hydrous mica (damourite) (?), are frequent in this locality.

In the bed of a little stream, Sand Rock branch, which flows into the river, about section 7, township 22, range 16 east, several varieties of rock are exposed. Of these rocks, quartz, thick-bedded and massive, forms the principal part. Alternating with these bars of quartz are beds of a greenish chloritic schist. North of Mr. J. S. Weldon's section 2, township 22, range 15 east, rises a high ridge of quartz schist and conglomerate, the highest ridge in this part of the country. The schist is of dark grey to whitish

colors, intersected by joints by which the rock is broken up into more or less regular shone-bridal shapes. The strata strike north-east and south-west, and dip about forty-five degrees south-east. Where the river cuts through this ridge, in section 1, township 22, range 15 east, there is a very high precipitous bluff. Much of the rock near the river is coated in patches with hydrous ferric oxide, which is iridescent, and this show of colors often quite beautiful, has excited the hope that copper may be found; but I saw no ore of copper. South of this quartz ridge, are passed alterations of quartz, fine-grained mica slates and argillites. One variety of the quartz resembles gneiss in appearance, being dark grey like that rock, though an examination with the lens showed no other mineral than quartz.

From Mr. Weldon's to Yellow Leaf creek, few outcrops of rocks were noticed, except occasional ridges of quartz schist, which, as the least destructible of the rocks of the vicinity, always form a prominent feature of the landscape. On Yellow Leaf creek, near Mr. Jeff. Johnson's, section 23, township 23, range 15 east, thick beds of argillaceous schists, of greenish black colors, crop out. These schists are traversed by seams of white quartz, and large masses of a sandy iron ore, likewise traversed with seams of quartz, lie strewn about the hill-side.

Crossing the creek, the iron ore increases in abundance, and the quality improves. At a little furnace erected by Col. James George, this ore becomes a porous brown hematite, frequently traversed by quartz, though some parts are free from it. The small furnace was put up for the purpose of reducing what was thought to be an ore of silver, and when the product was found to be only iron, it was abandoned. With these rude appliances, a considerable quantity of iron was made. Outcroppings of this ore may be traced for two miles, to the river, where it is found making up the principal mass of a hill on the bank of the river. Specimens of the ore from this place were similar to those from the furnace. Along the bank of the river,

across the outcrop, the ore may be traced for about a quarter of a mile.

Several excavations have been made at times along this ridge, in search of other metals, notably copper, but so far as my information goes, no other ore than that of iron has as yet been found. The outcrop of iron ore is said to continue on the other side of the river, along Paint creek, for nine or ten miles.

A few hundred yards below the iron ore, and on the bank of the river, is exposed a bed of limestone, an analysis of which I am not able to give as yet.

Both above and below the ore, the strata are similar to those at Johnson's, black greenish and brown argillaceous schists.

Analyses of the different varieties of ore from this locality are given below:

No. 1. Yellow ochreous earthy ore, cut by veins of quartz, from section 23, township 23, range 15 east, Chilton county.

Specific gravity........................3.14

Combined water	7.51
Siliceous matter	40.62
Sesquioxide of iron	46.12
Alumina	1.85
Oxide of manganese	0.29
Lime	0.39
Magnesia	0.75
Phosphoric acid	0.87
Sulphur	0.07
Total	98.48

Metallic iron, 32.30.

No. 2. Porous ore, of brown and red colors, with iridescent tarnish in places; streak dull brownish red; from section 23, township 23, range 15 east, Chilton county:

Specific gravity........................3.03

Combined water	7.16
Siliceous matter	1.61
Sesquioxide of iron	88.12
Alumina	1.35
Oxide of manganese	0.02
Lime	0.40
Magnesia	0.02
Phosphoric acid	1.33
Sulphur	0.20
Total	100.21

Metallic iron, 61.71.

No. 3. Compact brown hematite, partly fibrous, outer surface mamelonated, covered with a black glaze ; interior compact and ochreous ; streak yellowish brown; from section 23, township 23, range 15 east, Chilton county :

Specific gravity........................3.67

Combined water	10.90
Siliceous matter	9.26
Sesquioxide of iron	78.27
Alumina	1.65
Oxide of manganese	0.50
Lime	0.44
Magnesia	0.22
Phosphoric acid	0.23
Sulphur	0.03
Total	101.50

Metallic iron, 54.81.

The good quality of these ores is sufficiently shown by the analyses.

We have thus traced out, in an imperfect way, the succession of the rocks from near Verbena to the Yellow Leaf. This section is nearly parallel with the river, and distant

from it 1–5 miles, according to the sinuosities of the stream.

Let us now mark out, in some detail, the limit between the metamorphic area and the Modified Drift.

As stated above, Verbena Station is directly opposite the limit. A mile above Verbena, at Floyd's, the ford is over beds of syenitic gneiss. The warm brown soils of the vicinity are derived from this rock.

Towards Cooper's Station, the strata become more quartzose—with frequent ledges of quartz. In several places may be seen fragments of a coarse grained granite, with the feldspar much decomposed and the whole rock very friable. At Gullahorn's Mill, five miles from Clanton, there is an outcrop of a micaceous sandstone or a mica schist; the decomposition of the rock rendering an exact determination difficult. Beyond this, to Clanton, pine barrens and a swamp intervene.

At Clanton, the Modified Drift is the surface formation—and for a mile north of Clanton, the ferruginous sandstone common in the Drift may be seen frequently.

Near Mr. Jesse R. Jones, section 13, township 22, range 14, east, three miles north of Clanton, there is an occurrence of a ferruginous quartz breccia, with a ferruginous clay of fibrous texture, and varying in color from light yellow to vermillion. Some of the rock is compact smooth, breaking with conchoidal fracture.

West of Mr. Jones', the rocks are more sandy, and resemble more nearly the ferruginous sandstone of the Drift. About two miles east of Mr. Jones', the quartz ledges of the metamorphic formation are met with again. Much of this quartz, which is laminated, is colored with iron, the iron predominating occasionally, to such an extent as to become almost an ore of iron. This is possibly the termination of the ore bed described above. Dark colored argillites and greenish chloritic schists lie adjacent to the ore here, and are similar to the schists contiguous to the iron ore at Johnson's.

From the data given above, it will be seen that the line

between the metamorphic area and the Drift, in this part of the county, must be moved four or five miles west of the limit as laid down on the map accompanying Tuomey's second report.

TALLADEGA COUNTY.

TOPOGRAPHY.

At this time, we are concerned only with that part of the county lying east of the Selma, Rome & Dalton R. R. This road passes through the county in a north-east and south-west direction, in one of the valleys of the silurian formation.

Between this valley, in which the railroad lies, and the first hills of the metamorphic formation, there are one or two considerable hills formed by the silurian sandstones. Talladega creek has its head-waters among the metamorphic hills, and it cuts through the main quartzite ridge of this formation. The other two large creeks, Choccolocco and Tallasseehatchee, do not cut through this main ridge; though the waters of some of their tributaries are shed by the lower hills of the metamorphic, west of the main ridge. All the streams of this county are tributary to the Coosa. From the line of the Selma, Rome & Dalton road, between Alpine and Oxford, a prominent feature of the landscape is a high range towards the east, distant from the road 8–12 miles. This range has the name of Blue Mountain, over part, at least, of its extent. It is formed by strata of quartz schist and conglomerate, dipping about 45° south-east, and it is the highest range in the metamorphic formation. It is crossed by the Memphis & Savannah road at Rayfield's Gap, at a height of 896 feet above tide water. The bed of the road lies considerably below the summit of the ridge on both sides of the gap. The continuation of this ridge has been described above, near Mr. J. S. Weldon's in Chilton county. South-west of that locality, it is soon lost under the overlying Drift. The continuation of it north-east

will be more particularly noticed further on. In Chilton county, it is the watershed between Walnut and Yellow Leaf creeks. On the east side of the river it lies between Paint creek and Huxagulree, and further on, north-east, it divides the waters of Cedar and Tallasseehatchee creeks on the west, and Hatchet creek on the east. Further north-east the tributaries of Choccolocco, viz., Cheahah, Salt creek and Shoal creek, all head near this range.

GEOLOGY.

At Talladega Springs, section 16, township 22, range 2, east, the quartzites of the metamorphic are seen forming a high and precipitous hill south of the Springs—dipping east or south-east—whilst the silurian rocks below dip *under* them, a fact already mentioned by Prof. Tuomey.

This passage of the *newer* silurian rocks under the metamorphic, can be explained only upon the supposition that a fault intervenes, unless the metamorphic strata are to be considered as changed *silurian*. This state of things is to be noticed on the limit between the silurian and crystalline schists as far north-east as I have examined the rocks.

The springs are situated in a valley closed in by hills on three sides. On the south and east the hills are high and precipitous on the side overlooking the spring. At the foot of the hills the spring rises through strata of limestone. Ascending the hill south of the springs, there is a gentle slope of several hundred yards, over ground covered with fragments of quartz schist, of gray and whitish colors. After this gentle slope, begins a sharp ascent nearly 45°, over fragments of the same quartz schist, to the top of the hill, about 250 feet above the level of the valley. The crest of the hill overlooking the springs is formed of thick beds of quartzite, striking north 40° east and dipping south 50° east, at an angle of 15°. The beds are intersected by joints, one series of which has the direction of the strike, and is at right angles to the bedding planes: so that the precipitous bluffs overlooking the valley are formed

by these joint planes, which have a slope of 75° or nearly perpendicular.

About a mile north-east of the sulphur spring is a chalybeate spring which has a considerable local reputation.

This locality deserves a much closer study than it has been possible as yet to give it.

Between the springs and Syllacauga, in section 2, township 22, range 3, east, is the marble quarry formerly owned by Dr. Gantt. At present this property is in litigation, and no work is done at the quarry.

West of Gantt's, on the property of Dr. George Hill, is a bed of black limestone of crystalline texture, which receives a very fine polish. Still west of Dr. Hill's there is a quarry, opened and worked during the war, in the silurian slates. These slates are very fine grained and fissile, the beds dip 6°–10° nearly south-east and strike north-east. They are intersected by two sets of joints, one running north north-west and south south-east; the other east north-east and west south-west, dividing the slates into rhombridal blocks, which are about 12–18 inches in dimension. Near Dr. Hill's is a ridge of chert which passes, in places, into a fine grained sandstone, which sandstone was used during the war for grindstones. These occurrences, however, will be more particularly treated of in a subsequent report.

The white marble at Gantt's quarry has been placed among the metamorphic rocks, and thin seams of greenish talc interstratified with thick beds of the marble, bear out this view. The crystalline schists, hydro-mica slates, chloritic slates, &c., are seen about a mile east and south-east of the quarry.

From Syllacauga, towards the south, may be seen the high rigde of quartzite and conglomerate already mentioned. Seen from Syllacauga, there is a broad white line a short distance below the crest of the ridge, formed by the exposed edges of this rock.

About two miles north of Syllacauga, on the plank road, outcrops of argillites are exposed by the roadside, and near

the summit of the hill formed by these rocks, which pass into soft, unctuous slates, the limestone or marble may be seen in place *below* the slates.

Near Syllacauga, and north-east, towards Taylor's Mill, on Talladega creek, are the marble quarries of Messrs. Herd and Mr. Nix. These quarries and the marbles from them have been mentioned in detail in Prof. Tuomey's report, and I have nothing to add as yet to what is there said.

At Taylor's Mill, section 13, township 19, range 5, east, the first member of the crystalline schists, viz., a dark lead colored hydro-mica slate, sometimes of greenish tinge, is found in great force, forming the shoals and falls. This has usually been called a talcose slate, from its softness, pearly lustre, and soapy feel. A partial analysis of it, however, (which is subjoined) shows that it is a hydro-mica slate, or, as some have called it, a nacreous argillite.

Hydro-mica Slate, from Taylor's Mill, Talladega county.

Combined water	2.26
Siliceous matter	57.59
Protoxide of iron, Sesquioxide of iron,	8.81
Alumina	14.87
Lime	1.54
Magnesia	6.33
Total	91.40

Alkalis were not determined, and owing to an accident, the per centage of all, except the water and siliceous matter, are somewhat too low.

The creek has cut its way for some distance through this rock, which is worn into deep pot-holes, about a mile above the mill at the falls. The scenery presented by the bold bluffs of this rock is picturesque, and will well repay the trouble of a visit.

Not far from the mill, in section 12, same township and range, marble has been quar ied by Dr. Taylor. At this

place it underlies the slates. I give below the analyses, by Prof. W. C. Stubbs, of two varieties of this marble.

No. 1. White Marble from Taylor's Mill, Talladega county. White, crystalline structure; dissolves readily in acid.

Specific gravity......................2.70

Calcic carbonate	95.25
Magnesic carbonate	0.62
*Ferric oxide and alumina	1.15
Silica	2.95
Total	97.99

No. 2. Blue Marble from Taylor's Mill, Talladega county. Structure, crystalline. Dissolves readily in acid.

Specific gravity......................2.68

Calcic carbonate	94.40
Magnesic carbonate	0.41
†Ferric oxide and alumina	0.75
Silica	4.65
Total	99.21

Several miles higher up the creek, at Riddle's mill, in section 17, township 19, range 6 east, the same slates may be seen, passing towards the east into greenish, gray and yellowish slates. Near Mr. Riddle's mill a gold mine has been worked with some success. I regret that I could not visit the place, though no work was going on at the time.

On the ròad towards Ashland from the mill, after passing the variously colored slates just mentioned, a ridge of quartzite is crossed, passing into green chloritic slates, with angular fragments of quartz coated in places with chlorite. Interstratified with these greenish yellow slates, is an arenaceous schist of gray color. The main ridge of the mountains (Blue Mountains,) the high ridge of quartzite

*Chiefly alumina. †Chiefly ferric oxide.

and conglomerate is next crossed. At the top of this ridge the rock has nearly the color of granite, black and white intermixed, whilst on the eastern slope the prevailing color is gray or white. The western slope is more precipitous than the eastern, for on that side the edges of the strata are exposed. At the foot of the eastern slope of this mountain, at Mr. Chandler's, section 3, township 20, range 6 east, a chalybeate spring breaks out from amongst the strata of quartz. This spring has been much visited in times past—the water is strongly impregnated with iron.

On another road between Talladega and Ashland, the crystalline schists are first seen at Mr. Jack Seay's, section 35, township 18, range 6 east, about 8 miles east of Talladega. The line of Clay county passes close to this locality, and the further description of the geology will be found in the section relating to that county.

Near Mumford, the crystalline schists are found within three miles of the railroad. The first member of the series is, as usual, a hydromica slate. From Mumford I visited the "Silver Mine." This place is some 7 or 8 miles east of Mumford; it is dug into a rock very much decomposed and now very little more than a stratified clay. About 3 feet below the surface a thin layer of specular iron was cut. This layer is very irregular and not more than one-eighth inch in thickness. Below this nothing resembling a metal was found.*

* The excavation was begun and continued upon the faith of one of the innumerable Indian stories, which are current in almost every township in the State. A beach tree close by, with figures cut into the bark, (the supposed work of the Indians,) furnished the sole and only direction to this mine. The legend, which was brought forward to explain all, was simply a variation of the old story.

CALHOUN COUNTY.

As the crystalline schists in this county occur only in its south-eastern corner, making in fact parts of the boundary line between it and Cleburne, very little need be said in this place. Davistown, in section 11, township 16, range 9 east, is near the foot of the hills of hydro-mica slate which lie near the western border of the metamorphic region. In several places near Davistown, as I have been informed, the marble may be seen dipping under the crystalline schists, as is the case wherever it occurs southwest of this point.

CLEBURNE COUNTY.

Only the southern part of this county has, as yet, been examined. A full report of the geological relations here, of the metamorphic rocks can not, therefore, be made.

Going east from Davistown in Calhoun county, the metamorphic rocks are seen close to the town, the first rocks of the kind being, as usual, greenish and grayish argillites or hydro-mica slates. Here, as elsewhere, the slates alternate with beds of quartzite, sometimes massive, sometimes schistose. The strike northeast and southwest, and dip 40 and 45 degrees southeast, correspond to the general strike and dip of the rocks, throughout this part of the State.

About six miles east of Davistown is the Tallapoosa river, which flows, in this part at least of its course, through an elevated valley. The level of the river here, according to

the surveys, is much higher than that of the tributaries of the Choccolocco, which rise just beyond the mountain towards the west, and only a few miles distant.*

Beyond the river, east, are ranges of hills averaging 200 feet above the river, composed of hydro-mica slates and argillites, alternating with quartzites. Three or four miles from the river occurs the valley in which are situated the celebrated Arbacoochee mines. In this valley, the slight undulations, the completely decomposed schists, which are changed into beds of stratified clays, with interbedded layers of quartz, the angular fragments of which cover much of the ground, are very characteristic.

At the present time very little work is going on at these mines. I visited one locality where the gold was obtained from the surface deposits in the following manner: The gold bearing material is a dark colored loam, underlaid by a red clay, the result of the removal and re-deposition of the material of the underlying "slates." The "slates" are stratified reddish clays, which have resulted from the decomposition, in place, of the original schists.

In these "slates," are cut the trenches in which the water flows. Digging down a quantity of the top loam and clay, the miner throws it into the flowing water and follows it down with his shovel, breaking up the clods. In the little pot holes, worn in the "slate" by the running water, the gold is caught, and after a sufficient time the water is shut off and the contents of the little pot holes are removed, panned out, and the gold collected. These diggings are paying a small profit. So far as I am informed, Messrs. Denson and Ware are the only miners in this locality.

The whole face of the country about the old town of Arbacoochee has been dug over, the greater part of the work having been done soon after the first great excitement, about 1836.

In section 33, township 16, range 11, east, the Messrs. Hilton & Son, have a mill with eight stamps—steam power.

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* See Appendix B.

The auriferous rock is quartz, generally of a reddish or purple color, decomposed, and more or less friable; but the surface loam and clay, down to the "slate," are likewise thrown into the mill, and yield tolerably well. A variety of the auriferous quartz is called the *scab ore*, from the masses of brown iron ore, resulting from the alteration of pyrites disseminated through it. Other varieties of the quartz enclose unaltered masses of pyrites, a stubborn ore, since it will not yield its gold to the quicksilver; probably a preliminary roasting of the pyrite would, to some extent, overcome this difficulty. The gold here is disseminated in a very fine state, invisible to the eye, except in rare cases.

The valley in which the Arbacoochee mines occur, is drained by Dying Creek. In this valley the thorough decomposition of the schists, and their subsequent removal by denudation, whilst the interbedded layers of quartz less destructible, have been left behind, accounts for the great quantity of the quartz fragments which cover so much of the surface. The lower part of the hillside, south of Arbacoochee, resembles the valley in geological features; but the disintegrated schists of the valley are succeeded by mica slates, likewise much decomposed, and full of the moulds left by garnets. Following this are alternations of argillites and quartzite which pass into hornblendic gneiss, about two miles from Arbacoochee. Descending the hill into the hornblendic gneiss region, I observed many fragments of brown iron ore by the road-side.

The yellowish brown soil—light yellow on the weathered surfaces of the rock—with its growth of white, red, and Spanish oaks, sour gum, walnut, and hickory, contrasts strikingly with the soil of the hills on both sides of the valley. The characteristics of the soils derived from the disintegration of hornblendic rocks will be discussed in the agricultural part of a subsequent report.

Three miles from Arbacoochee, near Mr. Blake's, cyanite in considerable quantities has been found in the mica schists, which, together with quartzite and mica slates, in

many alternations, make up the main mass of the hill south of the hornblendic strata described above. Cyanite and large garnets are found, also, several miles northeast of Mr. Blake's, on the same mountain side. Towards Wood's copper mine, the mica schists and slates are succeeded by hornblendic rocks.

WOOD'S COPPER MINE.

This mine is in section 35, township 17, range 11, east. The discovery of a paying ore of copper here, in the spring of the present year, 1874, has caused a renewal of the excitement about copper, which was so intense some twenty-five years ago, when the famous Ducktown mines were opened.

It was during this excitement that Professor Tuomey explored this part of the State, and his disinclination to believe that every mass of porous oxide of iron, upon the surface, was an infallible indication of copper beneath, has caused injustice to be done him in many cases, and there are many men who believe that he denied the existence of copper in Alabama; yet, in his report, he has mentioned nearly every locality in the State where copper has actually been found. If his report delayed the discovery of copper by discouraging reckless investments, there can be no doubt that it has saved from disaster many who followed his advice.

At Wood's mines the country rock is a hornblendic gneiss, thick bedded, and approaching syenite. The strata strike nearly due north and south, and dip east 40°–45° The surface indications here, is the "gossan," a light, porous, brown oxide of iron, which is associated with a micaceous schist highly colored with iron. The vein, if it be a vein, is a bedded lode, lying between strata of the micaceous schist, which near the line of contact with the proper ore, is, more or less, impregnated with the copper, and when thrown out soon becomes covered with efflorescences of the sulphates of iron and copper. The gossan

overlies the ore, and a mundic—chiefly iron pyrites—lies below. This massive pyrites, is the limit of all the excavations made here thus far. The ore itself is principally a black earthy sulphuretted ore, usually called "black oxide," with some pyrites, or copper pyrites. Occasionally masses of cusprite, or the red oxide, has been found, and, rarely, the native copper. A few very handsome specimens of malachite, and azurite have been excavated; but all these ores, except the black ore and the yellow sulphuret are comparatively rare. The shafts, five or six in number, at the time of my visit, are about twenty-five feet deep, and are sunk upon the lode, at the distance of twenty feet from each other. The first shaft was sunk near the foot of the hill, the others higher up, but the average depth is the same in all—that is, the copper is found at the same depth below the surface of the ground, so far as it has been explored. The ore is hoisted by means of ordinary windlasses and buckets, thrown upon a platform near the mouth of the shaft, where the best only is put up in sacks for shipment. The sacks of ore are hauled to Carrollton, in Georgia, about forty miles distant, and thence shipped to the market in Baltimore. The expenses of mining, carting and freight, are about \$35—\$40 per ton of 2,500 pounds. At Baltimore the ore brings, on an average, \$60 per ton. Mr. Wood has been shipping his ore since May 1st, with a short interruption, and has sold during these four months about 300 tons, at the price mentioned.

There is of course much waste, since the lower grade ores are thrown aside as unprofitable, but it is the intention of the proprietor to erect works by which these poorer ores may be concentrated at the mine and thus fitted for shipment. Mr. Richard J. Wood, the owner of the mines, has spent much time in the search for a paying ore of copper, and his success at last has certainly been well deserved.

This lode presents associations of minerals very similar to those at Ducktown, as described by Prof. Storry Hunt. The black ore, according to the generally received explanations, is the result of a series of chemical changes, un-

dergone by the chalcopyrite in the upper part of the vein. These changes consist in the oxydation of the pyritiferous ores into sulphates, and their subsequent reduction. There results from these processes also, in the upper portion of the vein, the "gossan," a porous cap of hydrated iron oxide, which is more or less impregnated with the ores of copper in the lower part.

The oxydation of the pyritous ores into sulphates is going on all the time, and the drainage waters from the mines are charged with these salts.

The massive pyrite is immediately underneath the black ore, and no excavation has yet been made below it. At this place it holds, in general, very little copper, though at another opening, a mile and a half from Wood's, it contains, exceptionably, as much as 20 per cent.

A systematic exploration of these deposits by means of a diamond drill, is to be looked forward to with the greatest interest.

Here, as was stated above, a large proportion of the ore is rejected as too poor for shipment; the erection at the mines of works by which these low grade ores may be concentrated on the spot is in contemplation.

The working up of the vast masses of the sulphids may be made profitable in two ways. If the products of the combustion should be utilized in the manufacture of sulphuric acid, this industry alone might be made to pay the entire expenses of the working of the mines, besides yielding a handsome profit; and by roasting the ores in properly constructed kilns, from the residues, a portion of the copper, amounting to two or three per cent., may be extracted with profit, leaving behind a valuable ore of iron. (Hunt.)

The importance of sulphuric acid to the South, in the one item of the manufacture of fertilizers from the natural phosphates, cannot be overestimated. According to Hunt, the sulphur which goes to waste yearly at Ducktown would, if converted into sulphuric acid, be sufficient to manufacture 60,000 tons of fertilizers. The want of rail-

road communications at Ducktown stands in the way of the utilization of this product; so it will here; though there is the prospect that a branch road will be constructed from Carrollton, in Georgia; or that the continuation of the Opelika and Lafayette road may pass through this section of the country.

Other deposits of pyrites will be mentioned in connection with the description of the geology of Clay county.

One mile and a half, a little east of north of this mine, a shaft was sunk before the war by Mr. Hightower; and since the war, some work has been done there by Messrs. Wood and W. H. Smith. The ore raised has been chiefly iron pyrites, with a small per centage of copper, in some instances twenty or twenty-five per cent.; but the proportion of the latter ore has been small.

An analysis of a specimen of copper-bearing pyrites from this mine gave me the following composition in 100 parts:

Cupriferous pyrites from W. H. Smith's mine, Cleburne County.

Sulphide of iron (pyrite)	80.29
Sulphide of copper	10.14
Siliceous matter	6.68
	97.11

Metallic copper, 8.08.

The rock cut in sinking the shaft is a very tough mica schist, full of imbedded garnets.

This is in section 25, township 17, range 11 east, and about a mile north of it.

In section 24 there is a remarkable occurrence of brown iron ore. Part of this rock is full of garnets, some as large as one inch in diameter. By the action of the weather these garnets are left standing out from the face of the rock in relief. Considerable work has been done in the search for copper along the line of this rock, which may

be traced south-east to within a mile and a half of Mr. Wood's mine. In the immediate vicinity is a coarse-grained syenitic rock, porphyritic from the large crystals of hornblende which, upon the weathered surfaces of the rock, are exposed in relief like the garnets just mentioned.

Four or five miles west of Wood's mine, in section 31, township 17, range 11 east, is the locality described as Wood's mine in Prof. Tuomey's Report. This is now in part the property of Capt. W. R. Hanna. At the time of Prof. Tuomey's visit, a trench had been cut parallel with the branch in which the first traces of copper were found. This trench showed the copper disseminated through the rock for several yards, in the state of yellow and purple sulphuret, with some green carbonate.

A shaft had also been sunk to the water level, which showed the copper disseminated through the rock, but no lode was cut. These items are taken from his report. Since that time, however, other shafts have been sunk, though no paying lode of copper has yet been found. The coming on of the war caused the abandonment of this work, and it has not yet been renewed, though the presence of copper here is beyond doubt. The expense of sinking a shaft through the tough rock is very heavy, and this, together with the uncertainty of finding a true lode of copper, has caused this and many other similar enterprises to be abandoned. This place is near the old McIntosh road, and not far from the line between the mica schists on the south and the hornblendic gneiss on the north. I have received specimens of corundum, which were said to have been found about two miles north of the mine, but could get no definite information as to the locality. It seems well established, however, that the corundum has been found here. I should, perhaps, mention that a fine article of kaolni or porcelain clay has also been found in the same locality.

Towards Chulifinnee (north-west), the syenitic gneiss is succeeded by alternations of mica schists and argillites. Near the river at Riddle's bridge, the mica schists are

much decomposed, very soft, and full of garnets, and just north of the bridge the ground is covered with the crystals which have become detached by the weathering of the rock.

Beyond this, to Chulifinnee, the reddish clay soil, covered with the debris of the quartz seams, indicates the complete disintegration of the underlying slates. The gold mines are about three miles west of the village. At the time of Prof. Tuomey's visit, none of the quartz veins had been worked. At present, the Rev. Mr. King has a five-stamp mill, with water power. The gold here is found chiefly in the quartz veins in a talcose (?) slate, (it gives strong reaction for alumina). A shaft has been sunk upon a quartz seam, interstratified with the slate, and striking nearly east and west, and dipping about eighty degrees south.

The shaft was half full of water at the time of my visit, and a particular examination could not be made. This is in section 22, township 17, range 9 east, and in some of the adjoining townships the gold deposits have been worked, with more or less profit, for many years.

At the present time, a very few of the almost innumerable localities where gold is found in this State, is anything like systematic work going on, and I have therefore said very little concerning the gold deposits in this report. Twenty-five years ago the search for gold was prosecuted with much energy, and many localities are mentioned by Tuomey where the work has been abandoned for years.

RANDOLPH COUNTY.

TOPOGRAPHY.

The Tallapoosa river flows nearly north and south through the western part of the county, whilst the Little Tallapoosa, rising in Georgia, enters Randolph near its northeast corner and flowing nearly southeast joins the Tallapoosa a little west of the center of the county.

The tributaries of the Tallapoosa on the west, have their sources near the elevated region between Delta and Bowden. The tributaries on the east, rise near an elevated ridge which passes through the south-eastern part of Randolph and thence south and southeast, towards Lafayette and Opelika. This is the dividing ridge between the Tallapoosa and the Chattahoochee. Rondolph has, as yet, no railroad communication with the rest of the world, although the continuation of the Opelika and Lafayette road will some day pass through it. It is much to be hoped that this road will soon be completed, since it will furnish the outlet for the natural riches, both of this county and its neighbor Cleburne on the north.*

GEOLOGY.

In the southern part of Cleburne and the northern of Randolph adjoining, there is an instance of strata which show great variation in strike and dip, within a limited area. Thus in section 31, township 17, range 11 east, Cleburne county, the strata strike east and west, and dip south, whilst only a few miles north of this place the strike has the general northeast and southwest direction. In the

* See Appendix B, for profile of the projected road through Randolph and Cleburne.

same township, but in section 35, only four miles distant, the strike is north and south and dip east. This direction of the strike continues for some distance south into Randolph county, whilst the east and west strike at section 31 prevails south of that at least four or five miles into Randolph county, when the usual direction is again found. It is interesting to note, that in section 31 (Wood's old mine) copper has been found in small quantities, and it is probable that future explorations will develop a lode. In section 35 (Wood's mine, which is now worked), is found. It will be remembered, also, that a locality for corundum has been given as lying a few miles north of section 31.

In crossing Randolph county, from northwest to southeast, the following succession of strata may be observed:

Beginning with the locality just noted, section 31, township 17, range 11 east, in Cleburne, the rocks are chiefly mica schists, which are usually much decomposed, and of a purplish tinge. These schists hold, frequently, numbers of garnets, and those old excavations in localities where large plates of mica occur, the so-called DeSoto mines, are by no means rare. One of these excavations is in section 6 or 7, township 18, range 11 east. It is about fifty feet in diameter, ten or fifteen feet deep at present, and some of the largest pine trees are growing upon the debris piled about the mouth of the opening. The ground about the pit is covered with scales of mica, leading one to infer that mica was the chief mineral found, whatever might have been the object of the search. From the Georgia line southeast into Chilton county, upon this belt of mica schist, such excavations are popularly ascribed to DeSoto, and the same thing is true of the excavations in the soapstone in Chambers and Tallapoosa counties further south. It requires but a moment's reflection to show how improbable it is, to say the least, that DeSoto, in his march through Alabama, with the forces at his command, could have done all the work ascribed to him.

The mica schists just mentioned, have the east and west

strike and south dip, for four or five miles, and within this area, are the Pinetucky gold mines.

The first gold was found at this place in 1845, and for several years the work was prosecuted with energy, so that most of the surface deposits have been worked, and a good part of the area has been tunnelled under.

The gold is found in a thin layer of quartz, interstratified with the garnet bearing mica schist. The present proprietor of the mines, Ex-Gov. W. H. Smith, has sunk two shafts to the depth of sixty feet upon this quartz seam. The mill, of ten stamps, is driven by steam power, by which also the mica is drained and the water furnished for the ore washing. The gold is usually fine gold, in part intimately mixed with pyrites. Gov. Smith employs convict labor. The mill was not in operation at the time of my visit, as the miners were engaged in work in one of the shafts. Governor Smith gives as an average for the quartz mined here, $11 to $17 per ton.

The auriferous rock comes to the surface at several points in the vicinity of the works, and near the outcrop, the ground has been well worked over in former days. The mica schist, which is the conite rock, when freshly brought up from a depth of twenty to thirty feet, is a very tough rock, greenish gray in color, with deep red garnets, which can not be loosened from the fresh rock. After long exposure, it assumes the purplish tinge so characteristic of a large part of the rocks of this region; the garnets are weathered out and lie upon the ground by thousands.

Portions of this rock hold pyrite, the decomposition of which soon disintegrates the rock and covers it with an efflorescence of copperas. Notwithstanding the work done at this place, after heavy rains the surface deposits below the outcrop of the quartz, may be panned successfully.

Prof. Tuomey classes this place with Arbacoochee, as both belonging to the same belt of auriferous slates; but the conite rock in the two localities is different, the decomposition of the strata at Arbacoochee is much more complete than here, and, moreover, the two places, distant

about six to eight miles from each other, are separated by a succession of different rocks, so that the identity of the strata is, to say the least, very obscurely marked.

South of Pinetucky for three miles the strata of mica schist retain the east and west strike; beyond that, to within four or five miles of Wedowee, the strike is northeast and southwest, and frequent masses of a coarse-grained granite rock of light color are found. In these the plates of mica are quite large, the feldspar, as a general thing, is decomposed.

Masses of quartz with crystals of mica and tourmaline are also of frequent occurrence, especially in the mica schists near where the strike changes from east and west to northeast and southwest.

After crossing the river about four miles from Wedowee, fine grained mica slates, or perhaps hydromica slates, holding garnets, prevail. Near the river these slates are bluish, shining, and marked generally with fine folds or ridges upon the bedding planes. This peculiarity gives them the popular name of "curly slates." From the river to Wedowee, I noticed only rocks of this kind of bluish, greenish and purple colors, but always full of garnets.

Outcrops of massive granite, the flat rocks of the country, occur among these slates—for instance, at Blake's Ferry, south-west; and a short distance up the river, north-east of the Wedowee road. Outcrops of the same granite may be noticed at many points in this county, southward from Wedowee, as far as two miles below Milltown, in Chambers county.

Between Wedowee and Louina, the rocks are chiefly mica slates and mica schists holding garnets, usually much disintegrated; interstratified with these and frequently thin beds of a black carbonaceous or graphitic slate, which before the blow-pipe readily burns white, and melts to a white enamel; with cobalt solution, it gives a strong reaction for alumina, and a further examination shows the presence of some magnesia.

Acids have no effect upon the black coloring matter; but

when deflagrated with saltpeter, the resulting mass effervesces with acids. This black slate is quite soft, greasy to the touch, blackens the fingers like graphite, and is used extensively in the country for lubricating purposes.

Quartzites, massive and schistose, alternate with the strata above named, and many of the surface deposits from the disiutegrated rocks have been worked for gold. In section 20, township 21, range 11, east, and also at Mr. Peter Greene's, large, well cut crystals of quartz are found. Cyanite is also of frequent occurrence in the same vicinity. About three miles north-east of Louina, on Mr. George Forrester's land, section 30, township 21, range 11, east, an outcrop of gneissoid granite, covering several acres, was an object of interest. This rock forms the shoals at Berry Hill's ford across the Tallapoosa, and the village Flatrock takes its name from the great expanse of granite exposed there. Here, and elsewhere in the State where it occurs, it is manufactured into millstones. The bed of porcelain clay near Louina, a specimen of which was analyzed by Dr. Mallet, (Tuomey's Report) has never been utilized, though the analysis shows it to be admirably adapted to the manufacture of porcelain ware.

South of Louina to the Chambers county line, the strata are nearly vertical, and in many places the disintegrated rocks, scarcely more than stratified clays, the undulating country, the red soil with imbedded angular fragments of quartz, which lie also strewn upon the surface, are the characteristics of the gold region. At Louina, the mica schist is garnet bearing, and by its decomposition thousands of these crystals cover the ground.

Between Wedowee and Roanoke, the rocks are mica schists, alternating with quartzites and beds of black carbonaceous or graphitic slates, like those described just above. Where the road crosses Corn House creek, there is an occurrence of a dark green hornblendic schist interstratified with the mica schists. A few miles north of Roanoke, the quartzite is finely laminated, and resembles to some extent itacolumite. All these strata strike north-east

and south-west, and dip frequently at very high angles, 80 deg. or more, to the south-east.

Whilst in the vicinity of Wedówee, a specimen of cupriferous pyrites was shown me by Mr. Finch, who gave as the locality from which it was obtained, eight miles north-east of Wedowee.

Four or five miles south of Wedowee, I obtained from Mr. Wiley Mize, some very good specimens of magnetic ore.

CLAY COUNTY.

TOPOGRAPHY.

One of the most prominent topographical features of the county is the quartzite and conglomerate ridge which runs north-east and south-west near its north-western boundary. With the single exception of Talladega creek, all the creeks having their sources in the hills of Clay flow southward and westward to the Coosa and Tallapoosa rivers. Talladega creek, on the other hand, rising in the highlands east of this Blue Mountain ridge, flows down the valley south-westward for ten or twelve miles, then turns north-west, and cutting through the quartzites, argillites, and other rocks of the western border, flows through the silurian valley of Talladega towards the Coosa, not far from Childersburg. Where this creek cuts through the metamorphic ridges, several beautiful cascades are found—as above Riddle's Mill, and again at Taylor's Mill, a few miles below Riddle's.

GEOLOGY.

It will be remembered that at King's Gold Mine, in Cleburne county, the strata, talcose (?) and micaceous schists, strike nearly east and west and dip south. Going southward from this point, alternations of mica schist and hornblendic gneiss are passed, as far as Ketchapedrakee creek. The former rock predominates greatly, is usually much decomposed, and small garnets, loosened by the disintegration of the rock, cover the ground.

For three or four miles below (south of) King's mine, the strike of these strata is east and west, and the dip frequently nearly vertical towards the south. Beyond this,

for a short distance, north-east and south-west strike and south-east dip prevail; but at Mr. J. M. Kennedy's thick beds of mica schist, with garnets and pyrite, rise up abruptly from the valley. Through the ridge formed of this schist, the creek cuts its way. The strike here is east and west and dip 80 deg. or more south.

In a field near Mr. J. M. Kennedy's have been found many large pieces of magnetic iron; the soil in the field is the brown soil resulting from the disintegration of hornblendic gneiss. No vein of this ore has been found, so far as I know, but only the fragments spoken of. Some of these pieces show by their size that they are the fragments of a large vein. An analysis of this ore, by Prof. Stubbs, is subjoined:

Magnetic ore from J. M. Kennedy's, Clay county, Alabama. Easy fracture, powder brownish. Dissolves readily in acid.

Specific gravity........................3.85

Ferrous oxide	25.88
Ferric oxide	57.52
Alumina	6.00
Manganese oxide	6.24
Siliceous matter	2.75
Combined water	.91
Phosphoric acid	Trace.
Lime	"
Total	100.30

Metallic iron, 60.40. No traces of sulphur or titanic acid.

The freedom of this ore from the injurious mixtures with sulphur and phosphorous, is to be remarked.

A few miles east or north-east from Kennedy's, on Mr. Watson's land, a large mass of pure iron, now on exhibition at Woodstock furnace, was found some time since. Considerable speculation has been made concerning the origin of

this mass of iron, which was the only piece of the kind found; it seems probable, however, that it is a bloom from one of the old forges, south-west of this, and that it was accidentally dropped here. I am told that after the forges ceased their operations many loads of the blooms were carted off by the inhabitants, and the iron worked up for various purposes. It is, on the other hand, possible that the piece in question is of meteoric origin.

Near the dwelling of Mr. J. M. Kennedy, jr., in the gap cut through the ridge by the Ketchapedrakee, there is an old shaft, sunk in search of copper twenty years since, by the Tennessee Mining company. The shaft was sunk eighty feet through mica schist, striking east and west, and nearly vertical, though dipping somewhat towards the south. No copper was found; but much of the rock is pyritiferous, and the pieces thrown out are covered with an efflorescence of sulphate of iron. On the east side of this ridge, an adit was driven, some fifty or sixty feet, to cut the supposed cupriferous vein. The water which trickles through the crevices of the rock into this tunnel is charged with iron, and leaves a thick ferruginous deposit. It has a pleasant chalybeate taste, and has some reputation in the neighborhood. If at any time accommodation should be made for visitors to this spring, the rugged, picturesque scenery would make this an attractive place of resort. Below Mr. Kennedy's, at the mill, large masses of mica schist are exposed, and the ground is covered with the garnets. Between the mill and Delta, three miles south-east, the same rock prevails; the garnets loosened from the rocks here are usually not entirely free, but enclosed in an envelop of mica.

Between Delta and Ashland, the road lies in general upon a ridge of mica schist, or upon its south-eastern slope. Part of the country through which the road passes is called locally the Flatwoods. It is an undulating, rolling tract, very little broken, and the view from the higher points of the road, over the comparatively level Flatwoods, is quite attractive.

From Chulifinnee to Bowden, in Clay county, the road is down the valley, between Blue mountain on the west and the mica schist ridge just described on the east. The rocks underlying this valley are mica schist and hornblendic gneiss. Ketchapedrakee takes its rise in the upper portion of this valley, here called Fish Head valley, and on its way eastward to the Tallapoosa, cuts through the mica schist ridge. In the middle or lower part of the valley rises Talladega creek, which, flowing westward towards the Coosa, cuts the quartzite ridge of Blue mountain. Along the line here described, a railroad is projected, which joins the Coosa and Tallapoosa rivers without crossing any considerable height. The eastern side of the valley is noted for the number of shafts dug along it, in the search for copper, one of which has already been noticed; excavations for mica are also frequent along this belt of mica schist. Large plates of muscovite have been obtained a few miles west from Delta. East of that place, a bed of limestone has been observed and described by Prof. Tuomey, and the large size of the garnets enclosed in the schist near Delta is also subject of remark by him. I shall notice below another occurrence of these large garnets.

The general geological relations of Clay county may, perhaps, best be given in the succession of the strata noticed in crossing the county, from north-west to south-east, approximately at right angles to the strike. I shall, therefore, describe, in some detail, the route from Talladega to Ashland, and thence through Millerville (Hillabee) to Pinkneyville, in Coosa county; after which interesting occurrences of minerals not upon this route, so far as I have examined them, will be noticed.

From Talladega to Riddle's mill, section 17, township 19, range 6 east, the various strata of the silurian formation are crossed. At that place the first of the metamorphic rocks appears in the smooth, soapy-feeling hydromica slate, commonly called talcose slate, but which is shown by the analysis of the same rock from Taylor's mill to con-

tain comparatively little magnesia. Rocks of this sort, alternating with quartzite, prevail for four or five miles, and the physical features of the county are determined by the character of the underlying rock. Where the quartzites come to the surface they form the elevated ridges, the valleys between them being denuded out of the softer and more destructible slates. The vegetation changes likewise with the geological features. Upon the quartzites are little else than pines, and the hardiest of the pine woods herbs; in the more fertile valleys, oaks of various kinds associate themselves with the pines, and a more luxuriant undergrowth marks equally the change.

Of the quartzites, one ridge deserves particular mention, and this is the high Blue mountain, at this place about ten miles from Talladega. The quartzites composing this mountain are partly massive, though generally schistose, and a portion of this rock is a siliceous conglomerate. The prevailing colors are white and gray, but at the top of the ridge a mixture of white and black gives to some of the strata the appearance of granite. The western slope is the more precipitous, being formed of the broken edges of the quartzite. Near the foot of this ridge, on the western side, the slates assume a greenish tinge, due, in all probability, to chlorite, patches of which may be noticed upon some of the quartz fragments.

From the Blue mountain on to Mr. A. J. Withers', in section 36, township 19, range 6 east, argillites, hydromica slates, and thin beds of quartzite, which do not make any notable ridges, prevail.

At the latter place occurs a fine-grained hornblendic schist, one of the first of a series of hornblendic rocks which, alternating with mica schists, specular schists, and quartzites, make the country between Withers' and Ashland.

Near Mr. Withers', in section 1, township 20, range 6 east, is a large bed of brown iron ore, which partly supplied the old Rob Roy forge. A little creek flowing through this section forms several fine exposures of the

strata. A fall of one hundred feet in a few yards at one place marks a good site for a mill. Amongst the rocks exposed here is a soft, graphitic rock, with pyrites and laminæl of a soft green mineral, and near it is a stratum of ferruginous tufa, forming continually from the oxydation of the pyrites in the rock. A soft, black substance, which rubs off on the fingers, has attracted considerable attention, from its resemblance to the black copper ore, but an analysis shows it to be due principally to the disseminated graphite.

Near this is an old excavation in the mica schists, where the innumerable plates of muscovite show the object of the excavation. Some very fine crystals of tourmaline have been obtained from the granitic veins in the mica schist. Gold has also been obtained from the surface deposits near this place, though in no considerable quantities.

Continuing our geological section towards Ashland from Mr. Withers', we meet, first, strata of hornblendic gneiss, then a bed of mica schist, which, in weathering, disintegrates into small lenticular masses, each enclosing a garnet. Thence to the old Indian settlement of Candutchkee, in sections 14 and 15, township 20, range 7, east, hornblendic gneiss is the principal rock, alternating, however, with beds of quartzite, and arenaceous schists with scales of graphite. On the high hill composed of hornblendic gneiss, just west of Candutchkee, occurs a good bed of brown hematite. The soil, wherever hornblendic rocks prevail, is of the brown color so distinctive, and is generally quite fertile. One peculiarity of such soils is, their liability to suffer from protracted drouths. At Candutchkee, the hornblendic gneiss assumes the character of a true hornblendic schist, showing few traces of any admixture of foreign minerals.

Between Candutchkee and Ashland the country is much broken, and the physical cause of this may be sought in the frequency of the strata of quartzite there occurring. Much of these quartzose rocks are filled with scales of graphite. Nearer the latter town, hornblendic gneiss, with

the usual warm brown soil, and gently undulating country. I should not omit to mention the constant occurrence of fragments of hematite, with these hornblendic rocks, though I observed no outcrops of an *undisturbed bed*,—only the fragments.

Another geological section, parallel with that just given, and distant from it about five miles north-east, has some points of interest, and will serve to fix the succession of the strata upon the mind.

At the Rev. J. Seay's, in section 35, township 18, range 6, east, occurs what we have hitherto designated as the first member of the metamorphic series, a soft, unctuous, argillite or hydro-mica slate, usually called talcose slate. In calling this the first of the metamorphic series, I am not strictly accurate. By this term I intend only to designate that stratum, showing distinctively the characters of a crystalline schist, and lying adjacent to the less markedly crystalline strata of the silurian formation. The bed of crystalline limestone, or marble, which is found in many places dipping under the argillite, I have not usually mentioned as the first of the crystalline rocks, because its outcrops are not so generally visible as those of the argillite, being commonly hidden under the deposits of the valley.

From Mr. Seay's to the Blue Mountain, we meet with the same rocks, and in the same succession, as described in the lower route. About four miles from Mr. Seay's, in section 7, township 19, range 7, east, a "silver mine" was an object of interest. Like the "silver mine," so-called, already mentioned in Talladega county, this has an Indian story at the bottom of it.

A considerable amount of work has been done in drilling into hard quartzites, showing no indications of any metal except an occasional fragment of pyrites. The belief that the entrance to an ancient Indian mine has been discovered here, causes the continuation of the work, though there is no *geological* reason why silver should be looked for.

I should state, however, that in a fissure in the rocks, and

covered with dirt which had sifted through the cracks, were found a few pieces of charred wood, which gave some countenance to the belief that this cave had been visited before.

At the foot of the conspicuous quartzite ridge—Blue Mountain—on the south-eastern side, near Mr. William Jenkins', in section 29, township 19, range 7, east, seven or eight very fine springs burst up through the rocks. Some of these springs are decidedly chalybeate, leaving a thick ferruginous deposit. Others are free from any considerable quantity of mineral matter; all are found within a small area—not more than half an acre. The position of the springs at the foot of this ridge is identical with that of Chandler's, a few miles south-east. In the number, variety, and boldness of the springs, this place compares favorably with *Blount*. In a more easily accessible locality, they would be extensively known, and probably much visited.

A short distance above the springs, a large amount of a peculiar ferruginous tufa has been excavated. Associated with it, a black substance which soils the fingers, has excited hopes that copper might be found.

In Mr. Jenkins' field an outcrop of highly fissile clay slates, which are very good roofing slates, has been exposed. Strike nearly north and south, and dip 40 deg. east. Some of the slate is quite soft, and could be used for pencils.

Some two miles north-east from here, is another outcrop of the same or similar slates.

Near the house of Mr. Hollingsworth Watts, section 27, township 19, range 7, east, the mica schists are encountered, and the excavations made for copper are numerous. One of these excavations has been cut into a stratum of completely disintegrated schist, filled with cubic pseudomorphs of limonite after pyrites. Some of the cubes, upon being broken open, show a small nucleus of unchanged pyrites; in many, however, the change is complete. Here there seemed to be no other reason for the excavation than the

presence of these crystals. One mile west of Mr. Watts' is an occurrence of cyanite in large masses, and associated with this mineral are graphite, and a hydrous mica, probably damourite. The graphite was not noticed in any large quantity, although masses of cyanite, with associated graphite, were observed at several places. Many handsome crystals of tourmalin are also found in the same locality—generally so enclosed in quartz as to be loosened only with great difficulty.

In the road in front of Mr. Watts' house are numerous large garnets, some two inches in diameter, which have been loosened from the decomposing mica schist. They are seldom smooth, generally rough on the surface and rounded in outline, and seem to have undergone some decomposition. For a mile or more in a north-easterly direction this peculiar garnet-bearing stratum may be traced by the numerous free crystals which cover the ground. The schist has in many places disintegrated into a ferruginous, micaceous clay, and from such clays gold is obtained in considerable quantities. One of the gold mines formerly worked by Mr. Riddle, is not far from Mr. Watts', on the Ashland road.

Recently, a dam has been constructed and other preparations made for working systematically for gold near Watts', but as yet no regular mining work has been done.

In section 24, township 19, range 7, east, an excavation has been made under the auspices of Col. E. R. Smith, of Talladega. On the side of a hill, made up chiefly of a quartzose argillite, passing into a sandstone above, is an outcrop of a porous ferruginous tufa. A cut was made into this gossan, which is five or six feet thick, and below it, as far as the excavation has been made, (about ten feet from the surface) is a mass of crystals of pyrite, with grains of quartz, and little particles of indigo-blue sulphide of copper, or *covellite*. The bed of pyrite is about four and a half feet thick. Nothing like the black copper ore found at Wood's mines, has been discovered here, the only traces of copper being the blue grains. It will be a matter of

interest to prosecute this work, although it will be remembered that at Ducktown and Wood's mines, a black ore of copper is found between the gossan above and the unchanged pyritous ore beneath. At this place the change from gossan to pyrites is abrupt. One point is worthy of mention, viz: The pyritous mass here is not compact, but friable, and it has the appearance of some kinds of incoherent sandstones, in which the grains of sand (here represented by cubic crystals of pyrites, and grains of quartz,) are loosely cemented together, rather than of the solid mundic of the copper mines.

The following section will serve to make clearer the explanation given:

1 is a bluish quartzose argillaceous schist. 2 resembles 1, passes into a compact arenaceous rock-like sandstone above. *a* is the ferruginous tufa or "gossan" overlying *b*, the pyritous, sandy ore, which has grains of blue sulphide of copper disseminated through it.

About one mile north-east of this are the mines of the roasting and smelting works of the Montgomery Copper Mining Company, and half a mile from the works is the shaft from which the ore was raised. About the mouth of this shaft, and near the tunnel which intersects it, are piles of massive pyrites, made up of crystals of pyrite agglomerated together; in some specimens no other mineral was apparent; in others, grains of quartz. In this latter respect the sulphuret resembles that just described at Col. Smith's, though at his place no compact pyrite has been reached as yet. The enclosing rock at the two places is similar, with the exception that the quartz predominates

at Col. Smith's. The efflorescences on the refuse heaps show very little, if any traces, of copper, though I am informed that a small quantity of the sulphate of copper was manufactured here during the war. For the manufacture of *sulphuric acid* we have here a suitable material, and in large quantities. Let us hope that the near future may witness the establishment of this branch of industry in Clay county.

Four or five miles north-east of Mr. Watts', a spur breaks off from the south-east side of the Blue Mountain, at right angles to the general direction of that range, which is north-east and south-west. The precipitous rocks which may be seen near the summit of this spur indicate quartzites, and at the foot of the hills vast piles of quartz rock, which have rolled from the summit, are the only kind to be seen, yet the hill is clothed principally with a growth of cedar, a limestone loving tree. Near the foot of this spur are several bold springs with clear waters tasting of lime. I have noticed a similar instance of a cedar growth upon a spur of this mountain further south-east in this county.

The belt of mica schist with garnets, which prevails at Watts', passes, a few miles south-east of his house, into hornblendic gneiss. Near where the two formations join some work has been done in the mica schists, in search of fine plates of muscovite, by Messrs. Scroggins and Barton. None of the specimens which came under my observation were very large.

At Mr. Hurst's, near Bowden, an outcrop of an apparently massive hornblendic rock was examined, an analysis of which I give below.

Hornblendic Rock from Mr. Hurst's, near Bowden, Clay County.

Composition—

Silica	55.30
Alumina	3.72
Ferrous oxide	6.84
Lime	12.27

Magnesia	20.03
Brown oxide manganese	0.22
Potash	0.48
Soda	1.36
Combined water	0.59
Total	100.81

This rock is made up of pale green crystals, and upon fractured surfaces are frequent black metallic-looking stains. With this, and apparently resulting from its decomposition, are some large crystals of chlorite.

An outcrop of brown hematite occurs close by, probably a continuation of that observed a few miles south-west.

Thus far, we have followed a line parallel with that previously described. We shall interrupt here the north-west and south-east section, and notice some points of interest towards the south-west.

In section 3, township 20, range 7, east, on the property of Mr. George Hobbs, are two cuts made in search of copper. As one or two occurrences of a nature similar to this are to be noticed below, some detailed description may not be out of place.

In the bed of a branch, above the house, a ferruginous tufa was observed, which was supposed to be copper, "gossan." Cutting through this exposed a dark-colored clayey micaceous rock, with scales of graphite, and occasional lumps of pyrites. In this rock are, also, lenticular masses of a green lamellar mineral, similar to that noticed at Mr. Withers'. The mica of this rock is a brownish-black mica (biotite?)

No continuation of the ferruginous tufa was observed, nor has there been any discovery of metal other than pyrites. Half a mile further down the branch a shallow pit has been dug into, first a grayish sandy graphitic rock, with the lenticular masses of the green mineral mentioned; below that a stratum with more sand, which still lower becomes less sandy and passes into a black graphitic schist with very little sand. Where fissures

occur in the rock they are filled with a black unctuous substance, which resembles, somewhat, the black copper ore. This is shown by analysis to be an impure graphitic slate.

The presence of the iron sulphuret in these rocks explains the formation of the ferruginous tufa, which is in no place where I have seen it very thick.

Near Mr. Hobbs', on Mr. Wm. Ramsay's place, the specular schist assumes a peculiar character. Some of the rock is very coarse-grained, with large masses of the ferric oxide, which in general showed some degree of magnetic polarity. In other specimens, the laminated quartz greatly predominated, the plates and scales of micaceous iron being less abundant. This rock has been worked to some extent, under the belief that the iron mica was an ore of silver. A further examination of the metallic portions of this rock is necessary.

A mile from Mr. Hobbs, near Steed's mill, is an outcrop of the green hornblendic rock, similar to that noticed above, on Mr. Hurst's place, and associated with it a gray steatite, such as is found in Tallapoosa in the corundum region.

In the south-western portion of the county, section 17, township 21, range 6 east, at Mr. Garrett's, an excavation in search of copper has exposed a ferruginous tufa, or "gossan," beneath which are masses of iron pyrites, partly massive, partly made up of nodules of radiating crystalline pyrite, imbedded in a black mud impregnated with sulphate of iron, (copperas). The pyrite thrown out from the shaft soon decomposes, and is covered with an efflorescence of copperas, and upon pieces which have been exposed sufficiently long, the formation of limonite (brown iron oxide) may be observed. The whole process of the mode of formation of the gossan may here be seen at a glance. I saw no trace of copper in any of the specimens which came under my observation.

The strata here strike north-west and south-east, and dip north-east at varying angles. The principal rock is a schistose quartzite, which here forms a low ridge running

at right angles to the main ridges of the country, Blue mountain, and others.

This north-west and south-east ridge will be noticed again further south in Coosa county.

The two branches of Hatchet creek have their sources in this vicinity, on the south-east slope of the Blue mountain quartzite ridge, and on their way towards the Coosa they cut through the lower ridges of mica schist and hornblendic gneiss. The courses of these two branches of Hatchet creek here are determined by the direction of the quartzite strata just mentioned.

Between Mr. Garrett's and Mrs. McGhee's, section 3, township 21, range 6 east, the strike of the outcrops is north-west and south-east, and dip north-east.

At the latter place is a shaft sunk for copper. The country rock is a quartzite, very tough and compact, striking north-west and south-east, and dipping north-east nearly eighty degrees. At the time of my visit the shaft was nearly full of water, and only the upper portions of it were accessible. The shaft was sunk upon an outcrop of gossan, below which cupriferous pyrites have been reached. The copper-bearing stratum, or lode, (it lies between the quartzite beds), is enclosed in a pyritous quartz, which above, where exposed to the action of the weather, is red colored and porous from the oxydation and removal of the pyrites. Below may be traced the gradual change from the porous, friable rock, from which the pyrite has been entirely removed, to a more compact rock, in which the metal is still in place, but changed into limonite (brown hematite), and lastly to the original quartz, with its bright yellow pyrites.

(The figure below shows the relations of the upper portions of the shaft—all that could be seen.)

1, quartzite; 2 and 4, pyritiferous quartz; 3, gossan

above and copper-bearing pyrites below; 2, 3 and 4 may be identical.

This mine was worked to some extent several years ago, but with what success I am not able to say. Under the auspices of a new company, it is now in contemplation to push forward the work, and test thoroughly the extent of the copper-bearing vein.

The history here has been that of many similar undertakings in Alabama; a company with limited means, capital exhausted in the expensive work of sinking a deep shaft before a paying ore of copper was reached. Whilst no one can foretell with certainty what will be the quality or extent of an undeveloped metalliferous vein, yet with the evidence which we have here of the presence of copper, the further prosecution of the work becomes a matter of great interest. In this connection, I cannot too strongly recommend the use of the annular diamond drills, which are employed for the purposes of underground explorations with so much success, and with such a saving of time, labor and capital, which are only too often wasted in sinking shafts in the wrong place. In boring with these drills, a central core is left, which is subsequently drawn out, thus exposing the succession of the strata cut. The cost of such a drill, together with the expenses of boring, would be insignificant in comparison with the outlay necessary in sinking a shaft, which *might be useless;* and even in cases where there is no doubt of the existence of ore in sufficient quantity, by the use of the diamond drill one may choose the *best locality* for sinking the shaft.

Half a mile from the mine, a fine sulphur spring issues from between the strata of quartzite. The water is strongly impregnated, and will bear a comparison with that of some of the Blount springs.

In section 34, township 20, range 6 east, near Mrs. McGhee's, is the Haral gold mine, said to be one of the richest in Alabama. Much work has been done here, and a renewal of it is in contemplation, but at this time nothing is doing.

In the same section is another instance of a graphitic schist like that near Mr. Hobbs'. The graphite here, in tolerably large masses, is enclosed in an arenaceous rock. An impure graphitic slate, which soils the fingers like the black ore of copper, is also found near a ferruginious tufa.

At Mr. Robert Stringfellow's, section 19, township 20, range 7 east, is an occurrence of copper ore, mentioned in Prof. Tuomey's report.

The ores are the yellow sulphuret, and the black ore similar to that at Wood's. The lease of the company which began the work here and suspended operations before actually determining the extent of the lode, having recently expired, the further development of this mine lies it is to be hoped, in the near future. The prospect of finding a valuable deposit of copper, is certainly very good. The black ore is found beneath a capping of ferruguious tufa, and above a mass of copper bearing pyrites. This pyritous ore is at the bottom of the shaft; no search has been made below it. The sides of the lode are formed of thick beds of a slaty, arenaceous rock, with disseminated graphite. The strata here strike northeast and southwest, stand nearly vertical, but with a slight dip southeast.

Northwest of the shaft, the succession of rocks is first hornblendic gneiss, and next a mica schist filled with garnets. Towards the south-east the graphitic schist continues to the foot of the hill.

I give below a section of these rocks:

No. 1. Mica schist with garnets.

No. 2. Hornblendic gneiss.

No. 3. Arenaceous quartzite with graphite.

No. 4. Lode with the ore between the gossom above and pyrites below.

Between Candutchkee and Millerville (Hillabee P. O.), the road passes over strata of disintegrated micha schist, full of garnets; but near the former place a belt of graphitic schist is passed before the mica schist is reached.

Within two miles of Millerville the mica schist ridge upon which the road lies, ends, and at the latter place we come once more upon the strata of quartz schist, with northwest and southeast strike, and northeast dip about 25 degrees.

Rocks with the same strike and dip are found as far southeast as Squire Munroe's mill, half a mile below Millerville, as far as I went in this direction. It is probable that the strata for several miles below Millerville, towards Brownville, have this strike. Near Squire Munroe's an occurrence of small quantities of magnetic iron, in quartzite, was noticed. The sandy portions predominated greatly, in all the specimens which came under observation.

Between Millerville and Pinckneyville are seen argillites in all gradations, from soft, soapy feeling rocks, to hard schistose quartzites, with a small admixture of alumninous matter. About two miles below Millerville the slates are very rich in carbonaceous matter, (graphite), which gives them an unctuous feel, and a black shining streak. These slates readily burn white before the blowpipe.

In some places excavations of considerable extent have been made for graphite. Where the rocks have been thrown out of the pits, the piles of black rubbish remind one of the coal regions. This carbonaceous or graphitic slate, is said to answer very well as a lubricator.

Where the road crosses a branch of the Hillabee, a few miles from Pinckneyville, are outcrops of thick-bedded gneiss, or granite, and between this and the latter town strata of gneiss are crossed.

The accounts of the occurrence of tin in Clay county, so often seen in the papers, appear to have originated from the discovery of a remarkable specimen near Millerville. It is said that the specimen in question was found upon analysis to consist of tin, lead and bismuth. As tin is

found only as tinstone (the oxide) and the rare tin pyrites, this is not a natural occurrence, but an *alloy*. Only a single specimen of this *alloy* has been found, as I have recently been informed by its discoverer, Dr. Coker.

COOSA COUNTY.

TOPOGRAPHY.

A dividing ridge from the northeast corner of the county towards Nixburg, separates the waters of the Tallapoosa on the east and the Coosa on the west. Thus, the greater part of the county is drained towards the Coosa, and near that river may be seen some of the most striking effects of denudation. The Weoguffka and Hatchet creeks, and their tributaries, have cut deep ravines in many places; and the counterpart of this broken country may be seen in Chilton county on the other side of the river.

GEOLOGY.

From Pinckneyville in Tallapoosa to Bradford, Coosa county.

The gneissoid rocks at Pinckneyville strike northeast and southwest, and dip 40 or 45 degrees southeast. Two or three miles west of that town, after crossing alternations of gneiss and mica schist, with the strike and dip given above, we come in our geological section upon a series of rocks striking nearly north and south, or a little west of north and east of south, and dipping nearly 90 degrees east. The main body of the ridge formed by these strata, consists of quartzites, often porous, with sharp gritty feel, and covered with a black film. A few of these schists are more compact, and traversed by irregular seams of a light colored micaceous mineral not determined. The eastern flank of this quartzite ridge is made up of alternations of gneiss and mica schist, with fine grained mica slates; on the western side mica schist and quartzites.

This ridge, which marks the dividing line between the

waters of the Coosa and Tallapoosa in this county, may be seen from this point, stretching some distance into Clay county. Its continuation northward I have not yet had an opportunity of determining, though I think it probable that the quartzite strata noticed near Millerville, Mrs. McGhee's, and other places, belong to the same series of transverse folds.

Towards Socopatoy and Bradford the gneiss, which is the prevailing rock, has the normal strike and dip again.

In the west half of section 32, township 24, range 20 east, on land belonging to Mr. Samuel S. Graham, are several outcrops of what is structurally a true granite,* since large flat masses, forty or fifty paces in diameter, show not the slightest traces of bedding. This rock, which makes a beautiful building stone, lies within three miles of the Savannah & Memphis Railroad. The texture is so uniform that it may be split off equally well in all directions. The size of blocks which could be obtained here, would be limited only by the means of quarrying.

Much of this granite has already been used in the construction of the Bradford factory, and recently in the building of culverts and bridges on the railroad.

The comparative ease with which it can be quarried and worked up, its fine quality and handsome appearance, will enable it in the future to compete with the best building stones of the country.

I have spoken of this rock, as structurally, a true granite. It passes, however, on each side by insensible gradations, into gneiss; thus at Bradford, two miles distant, the

* The granite consists of a moderately coarse grained mixture, chiefly of quartz and feldspar, the latter predominating, in which are disseminated scales of white mica (muscovite), and brown or black mica (biotite.) The quartz is smoky white, the feldspar white, and on the clearage faces of some of the feldspar may be seen undoubted twin struations. The mica crystals are by no means in parallel arrangement, but are inclined at all angles. Surrounding most of the scales of brown mica, are brown ferruginous stains, which cover the adjacent particles of feldspar and quartz. The rock is therefore a typical granite, of predominating orthoclase, with some oligoclase, much quartz, and scales of muscovite and biotite.

rock is an undoubted gneiss, though a hornblendic gneiss occupies part of the intervening space.

In other parts of the State where it comes to the surface it presents nearly the same features as here, viz: isolated broad flat expanses of smoothly weathered rock, which in general shows a tendency to exfoliate in concentric shells. In other localities I have noticed the transition into gneissoid rock, where it is more clearly exhibited than here.

Occurrences of "flat rocks," as these exposures are called locally, have already been mentioned.

In this county the north-western limit of this granitic belt may be traced towards the south-east, passing a little west of Rockford, and on towards the Coosa river, below the mouth of Chestnut creek. North-eastward it comes to the surface a short distance north of Pinkneyville, and thence towards Wedowee. A fine exposure of granite may be seen at Blake's ferry, on the Tallapoosa; above Wedowee another, and thus on to the Georgia line. In a south-east direction, the gneiss prevails, with occasional strata of hornblendic gneiss, and quartzites, as far as the steatite and hornblendic belt, with associated mica slates and argillites, which is crossed before reaching Dadeville.

Throughout this region, especially in Chambers and Randolph, these outcrops of massive gneiss—granite, if it may so be called—are frequent.

A geological section from Bradford, north-west towards the Talladega line, shows the following succession of rocks: Near Bradford, gneiss, passing into hornblendic gneiss, succeeded by thick bedded gneiss, or granite, occurring at Mr. Graham's; then mica schists, alternating with hornblendic gneiss and argillites. Above Mt. Olive, near Mr. Thomas Lambert's, bluish or ash colored graphitic schists, with only scattered scales of the graphite, are found in force. With them are associated quartzites, frequently containing occasional scales of the same mineral, and dark-colored quartzites holding iron pyrites, the decomposition of which stains the surface of the rock, and

imparts the peculiar astringent taste to the water percolating through it.

In sections 9 and 16, township 24, range 19 east, upon high, precipitous ridges, formed by the denuding agency of the waters of Weoguffka, are extensive beds of a ferruginous tufa, which have been supposed to be a copper gossan. This interesting rock is enclosed between beds of graphitic schist, and it exhibits a great variety of colors, from the brown of ordinary limonite (brown hematite) to the deep red of iron oxide, (hematite). Many cavities or pockets in the rock are filled with this deep red pulverulent oxide. Such cavities are often lined with concentric shells of tolerably compact oxide of iron of brown and reddish colors. Where fissures occur, the surfaces are commonly covered with a mettalic film, which shows a variety of iridescent colors; the iridescent film, however, can easily be scraped off with the knife. The same iridescence may frequently be found upon the quartzites lying near the beds of iron ore, a suggestive fact, especially when it is considered that this iridescence is looked upon as indicative of copper. Indeed, wherever such iridescent colors are found, whether upon ferruginous tufa or upon quartzites, they are called "copper colors." They are, however, undoubtedly caused by a thin film of oxide of iron, and may be found upon any rock.

I am informed by Mr. Lambert that the thickness of these beds of gossan—using the word as a synonym of ferruginous tufa—is considerable, eight to ten feet at most.

An average sample, upon analysis, has the following composition:

Analysis of "gossan" from section 9, township 24, range 19 east, Coosa county. A porous ore, made up of irregular layers or shells of compact brown hematite, with similar shells of red, the latter sometimes passing into a red powder. Cavities lined with small botryoidal masses of brown hematite, often iridescent. Occasional yellow ochreous

masses are mixed with the brown layers. Powder dark red.

Specific gravity ....3.40.

Combined water	9.79
Siliceous matter	1.78
Sesquioxide of iron	83.13
Alumina	3.67
Manganese	0.19
Lime	.50
Magnesia	.04
Phosphoric acid	.76
Sulphur	.61
Total	100.47

Metallic iron, 58.22.

From the above it will be seen that it is a fair ore of iron.

The presence of 0.61 per cent. of sulphur may afford some hint of the origin of the tufa. Iron pyrites, as was mentioned above, is a common ingredient of the rocks in this particular vicinity, and it has probably been from the oxydation of pyrites that the tufa has been formed.

I should not omit, in this connection, to state that a piece of cupriferous pyrites was shown me by Mr. Lambert, which was said to have been part of a vein exposed in one of the cuts on the Memphis and Charleston Railroad, some miles east of his house. If I am not mistaken in believing the specimen to be cupriferous, I have not had a piece for analysis, nor have I as yet had an opportunity to examine the locality from which it came. A thorough exploration of this vicinity may result in the discovery of a lode of copper ore.

South-west of this place, near section 11, township 23, range 16 east, I am told graphite has been found, though I have seen no specimen of it. From section 11, towards Zimmerman's ferry, the peculiar sterile hills of decomposed mica schist, which imparts a purple tinge to the soil, pre-

vail. The mica is frequently seen in tolerably large crystals, but when found upon the surface, it is always very brittle. The extension of this belt of mica schist, across the river, has already been described in Chilton county.

Near Smith's ferry, at the mouth of Hatchet creek, in section 2, township 21, range 16 east, on the property of Col. James George, is another occurrence of rock similar to that of Mr. Thomas Lambert described above. Here several shafts have been sunk in search of copper. The typical rock is a chist of flattened lamallar of quartz, with scales of graphite. It passes, on the one hand, into a ferruginous quartzose tufa, with graphite and occasional pockets of red pulverulent ferric oxide; and on the other hand, into a brown stained, porous or compact quartzite, the cavities of which are lined with botryoidal masses of hydrated ferric oxide, covered with shining, iridescent films of metallic lustre, and green, blue and red colors. The faces of the joints of the more compact quartzite are also covered with the same iridescence.

Near the surface, these rocks are much decomposed, and pass into grayish, yellowish and reddish clays, the original lamination of which is shown by the parallelism of the scales of graphite and the interbedded layers of quartz. In the shafts occasional thin beds of white clay are cut.

It will be seen that rocks here, in their varieties and associations, resemble those at Mr. Lambert's, some twenty miles almost due north-east. I have seen no specimen from either place which shows a reaction for copper, though if the existence of a cupriferous lode, exposed in the railroad cut east of Mr. Lambert's, be well established, reappearances of the same lode may reasonably be looked for towards the south-west, in the continuation of the same series of rocks. In that case, it is not at all impossible that copper may be found in the vicinity of one or both of the localities in question. Across the river, in section 32, township 21, range 16, east, on Chesnut creek in Chilton county, the same rocks are found; there as here, the iride-

scent colors have attracted attention, and some work has been done in search of copper, where they have been noticed.

As I have stated above, this iridescence has no necessary connection with ores of copper, though it has some slight resemblance to the peculiar colors of variegated copper ore. It may be seen, like the ferruginous tufa, or "gossan," wherever brown iron ore is formed from the alteration of pyrites, or some other ferruginous mineral. The true "copper colors," in addition to those of the variegated ore, are due to the blue and green carbonates, and the sulphate of copper, formed from the oxydation of ores which contain copper, and in which the *presence of copper may be shown by a chemical test.*

On the other hand, the ferruginous tufa, or "gossan," resulting from the oxydation of *copper bearing* iron pyrites, may often show no "copper colors," may often be destitute of any trace of copper, in its upper portions, near the surface, especially where it is exposed to the leaching effects of atmospheric agencies.

To say the least, then, the sinking of expensive shafts, where the presence of copper is not actually and unequivocally demonstrated, is a hazardous venture.

The gold deposits of Coosa are worked at present only on a very limited scale. I know of no locality here where the quartz veins are regularly worked. The gravels and sands of the branches and creeks may occasionally be panned with profit.

Thz southern part of this county has not yet been visited, and a discussion of its geological relations must be deferred or a future report.

TALLAPOOSA COUNTY.

TOPOGRAPHY.

There is no prominent dividing ridge in this county, and an enumeration of the minute topographical features would carry us too far. The Tallapoosa receives all the drainage; the two large creeks, Sandy and Sougahatchie, flowing into it from the east, have their sources near a high ridge which traverses Chambers and Lee counties, and which will be more particularly noticed below.

GEOLOGY.

The mica schist which alternates with gneiss at Pinkneyville may be seen east of that place for several miles, to the Onotachopko creek; throughout this region it also alternates with strata of gneiss. Beyond the Hillabee, the valleys are filled with rounded quartz pebbles, such as characterize the drift deposits further south.

The gneiss is succeeded by mica slates, holding crystals of andalusite; others full of moulds left by decomposed garnets.

East of Sorrell's mill, section 3, township 24, range 22, east, dark gray or bluish fine grained mica slates, with smooth surface, and often enclosing between the layers lenticular masses of quartz.

Two miles west of Goldville occurs an outcrop of a fine grained quartzose mica schist, or quartzite, with a small admixture of mica, and with this is associated a slate which, upon the bedding planes, shows small irregular ridges or folds, smooth to the touch. These rocks occasionally hold garnets, and most of the scattered fragments enclose lenticular masses of quartz.

The colors are varied, from bluish gray to lighter colors, pinkish and purplish. With these rocks our section enters the gold region, an undulating, but by no means broken country, timbered with a variety of oaks and but very few pines. Traces of the old gold diggings are yet to be seen, but any systematic or continuous working of these deposits has long since been abandoned.

From Goldville, towards Germany's ferry on the Tallapoosa, a continuation of the section will show mica schists holding garnets, often much decomposed, passing into light colored micaceous quartzites which approach itacolumite. Within three miles of the ferry occur hornblendic gneisses with quatzites, which continue, with many alternations, across the river to within three miles from Dudleyville, where steatite and other magnesian rocks are associated with the hornblendic gneiss.

In the region of micaceous quartzites just mentioned, the soils are generally light colored, and timber almost exclusively of pine. Upon passing into the hornblendic land, the change in the character of the vegetation, no less than the color of the soil, is very marked and abrupt.

Near where the first outcrop of soapstone is observed, deep beds of white sand and rounded quartz pebbles fill the slight depressions of the generally almost level country. The rounded quartz grains composing the sand have all the characteristics of the grains of sand of the modified drift.

About two miles west or north-west of Dudleyville, corundum was discovered in the fall of 1871, by the Rev. C. D. Smith, of Franklin, N. C. This discovery is in many respects of extreme interest to the mineralogist and geologist.

The following letter, furnished at my request by Mr. Smith, will be read with interest:

FRANKLIN, N. C., Oct. 30, 1874.

Prof. Eugene A. Smith, Tuskaloosa, Ala.:

DEAR SIR—In compliance with your request, I proceed

to furnish you a brief statement respecting the discovery of Corundum in Alabama. In the fall of 1871, some gentlemen of Atlanta, Georgia, employed me to make some explorations for Asbastus, and after some examinations in Georgia, they sent me to Dudleyville. I learned from Prof. Tuomey's report that there existed a range of what he styled soapstone ridges lying north of Dudleyville. I immediately went from Dudleyville towards Perry's Mills, and in the road-bed at Mr. W. B. Pinkston's found the first corundum. A few days afterwards, I found two or three specimens on the lands of Mr. John Shanks, in the immediate neighborhood of Mr. Pinkston's. The exploration for corundum ended for the fall of 1871 with these discoveries. In the spring of 1872, I returned to Dudleyville, with a view to complete the work I had engaged to do for the parties in Atlanta. During my last visit, I discovered corundum at several localities on the Pinkston zone, along a distance of six or seven miles. Some of these localities I am not allowed by the proprietors to make public at present. This account of my discoveries I have thought proper to give, before entering upon the discussion of Corundum, and the mode of its occurrence. I regard it eminently proper, also, to make a brief reference to the geology of the country before entering upon the proposed discussion.

The axis of upheaval passes from the termination of the great mass of the Blue Ridge at or near the head of Long Swamp in Pickens county, Georgia, by a line of ridges into Alabama, forming the watershed between Chattahoochee and Tallapoosa rivers. The town of Lafayette, in Alabama, is located upon the summit of this upheaval. The rocks of this central mass are not so well developed, nor so well defined, in Alabama as they are in North Carolina and Georgia. They, however, all along this central axis, bear an air of the greatest antiquity, and are entitled, by a careful classification, to be named Azoic rocks. Perhaps those writing text books would call them metamorphic rocks. The principal beds are gneiss, with occa-

sional out-crops of granite. I have observed on the Chattahoochee, as well as on the Tallapoosa slope, frequent beds of hornblendic rock, usually the variety, syenite. Between Lafayette and Dudleyville I observed, in passing, a trap dike.

A few miles above the Horseshoe bend the rocks of the Taconic system of Emmons, cross the Tallapoosa river to the south side. I saw only the drab-colored Talco micaceous slates, quartzites and clay slates. I, however, did not pass northwards across the whole series. These rocks belong to the oldest sediments and were deposited anterior to the lower Silurian age. The rocks here and in Georgia lie in the same order.

Between these Taconic beds and the axis of upheaval lies the zone which bears Corundum. This zone consists of gneiss and mica shales in which there exists a system of chrysolite dikes. The chrysolite, however, comes to the surface sparingly, but the accompanying rocks are abundant. Steatite abounds on every out-crop, and the same may be said of a very porous chalcedony arid Asbestus. Most of the steatite is impregnated with anthophyllite, which makes it rather a tough rock, suitable for the manufacture of ancient pottery. Indeed, there are frequent excavations where such pottery has been made.

There are also heavy beds of hornblendic rock accompanying these dikes. The principal beds which I examined are dioritic. The rock is mostly composed of hornblendic and albite. These dikes do not form a regular and successive outcrop. They show at intervals, and somewhat alternate in the zone of rocks that enclose them. Wherever I found the crysolite coming to the surface, I found corundum.

At Mr. Pinkston's the corundum has as its immediate associates, tourmaline, emerylite and chlorite (the variety ripidolite). The small vein which I explored, is located in steatite, chlorite and chalcedony. The great amount of associated minerals at that locality is to be regretted, because otherwise the corundum is of good quality. On the

lands of Mr. John Shanks, adjoining the lands of Mr. Pinkston, there also occurs corundum having like associates. At one point on Mr. Shanks' land I obtained, by panning, an abundance of small imperfect crystals. It may be that crystals of greater purity will be found at that locality.

Upon the adjoining lands, now owned by Mr. James Johnston of Dudleyville, I found corundum of superior quality. It occurs of larger cleavable faces, of gray and blue colors, and less mixed with associated minerals. The chief associate at this point is ripidolite. The masses here are larger and more angular, and give evidence of a larger vien. I prospected in a small way for the vein, but did not discover it. I, however, believe that a vein may be found on this property. Should it be discovered, there is promise that the material will be excellent and that fine cabinet specimens will be obtained.

South-westward on the range I discovered corundum at several points, in small fragments and usually much mixed with the associated minerals. Indeed, there is much reason to suspect pseudomorphic action in these veins. Should this be true, it will materially affect the corundum for abrasive purposes. Of this, however, I am not certain, because my examinations have been too limited for positive determination.

So far as my explorations extended I did not find a sufficient amount of corundum to make it an object for mining operations. There are no well grounded reasons, however, why it may not exist in large quantities. The country though is so flat, and the outcrops so much broken down, that the veins will be difficult to find. Most of the specimens I obtained were much weathered and water worn, showing that they had been shifted a good deal. Indeed, I found but little rock which has not been much weathered and contorted, perhaps by diluvial action. This renders the search for veins *in situ*, much more uncertain than in North Carolina, where the steepness of the mountains with the action of water and weather, have exposed the gneiss

that encloses the chrysolite outcrops. The chrysolite here is often bare for quite a large area, and the gneiss enclosing it well exposed and lying in undisturbed order. It is, therefore, comparatively easy to arrive at the locality of veins where they exist.

There is one fact interesting to science in regard to these chrysolite dikes, worthy of special remark. The principal mass of the Blue Ridge is a fold, which being lapped together, was pushed over to the northward and left standing at an angle of about forty-five degrees. The disturbing force which opened the dike fissures, acted mainly on the north or underside of this fold. The zone of disturbance extends from the Yellow Mountain in Mitchel county, North Carolina, to Track-rock in Union county, Georgia, a distance of about one hundred and ninety miles. Its strike is nearly or quite southwest, and occupies a position about equidistant between the summit of the Blue Ridge and the Taconic beds on the north. The outcrops in Tallapoosa county, Alabama, hold the same relation to the Taconic rocks and the axis of upheaval that they do here, showing that the dike producing focus acted throughout, in conformity with the central mass folded together in the upheaval and tilted over towards the north.

The alumina of which corundum is composed seems to have crystalized during the process of filling the dyke fissures. Some facts have fallen under my observation that awaken a singular interest in connection with the crystallization of corundum. While in its composition it is pure alumina, the associated minerals are all silicates of alumina, combined with several other mineral substances. This relationship is singular, when we consider the laws generally supposed to govern crystallization. The corundum and its associated minerals seem to have crystallized at the same time, arranging themselves in conformity with each other's crystalline faces. Why and how the alumina should crystallize without admixture in the form of corundum and the margarite, ripidolite and tourmalin, being compounds of alumina and other substances, should crystallize at the

same time, adjusting their forms of crystallization to each other, is certainly an intricate and interesting problem. I have seen specimens showing that the corundum had adjusted itself to ripidolite, and then again instances in which the ripidolite had evidently adjusted itself to the corundum. I have a specimen showing corundum and tourmalin interpenetrating each other in acicular points. This fact does not very well agree with the idea of pseudomorphism. It rather has the appearance of simultaneous crystallization, and shows how intimately associated these minerals are. It is singular enough, however, that the alumina which enters into the composition of the tourmalin did not enter into the corundum.

This dike system, with its relations to the axis of upheaval and its great length, deserves thorough and patient investigation. From the crystals already obtained, some of which are suited for gems, and the general tendency to crystallization, especially at some of the localities, I am persuaded that judicious explorations will bring to light gems of great value; and I hope that Alabama will share the honor of producing the oriental gems. If my circumstances were such as to justify it, I would, during the next year, make a more thorough and complete exploration of the entire dike system, as it passes from North Carolina through Georgia and into Alabama. I am sure such exploration is eminently deserving; and I am equally impressed with the belief, that at some point or points along the zone of outcrops precious stones will be discovered. Moreover, it is due to American geology, due to the progressive age of science, and due especially to our bright south-land, that such exploration should be thoroughly and patiently made. To accomplish this, it will require time and the labor of intricate science. Perhaps I may yet be able to work out some of the problems of this wonderful dike system.

Truly yours,

C. D. Smith.

On Mr. Pinkston's land many crystalized specimens of corundum are found. One crystal, now in the Cabinet of the Survey at the University, weighs fifty-two pounds. Other hand specimens from this place show surfaces covered with small crystals an inch in length and less.

The associations of the corundum in the vein exposed on this land have been given in Mr. Smith's letter. One of the most interesting of the alterations of corundum shown by these specimens, is that into tourmalin: a nucleus of corundum surrounded by tourmalin.

Near Mr. B. W. Henderson's the corundum is associated principally with tourmalin, actinolite, and chlorite; some specimens showing corundum penetrated by the long crystals of tourmalin. The accompanying rock here is steatite, with interlacing crystals or fibres of actinolite, or anthophyllite.

Large masses of chlorite schist also occur here. Some miles south-west of Mr. Henderson's, angular fragments of corundum, with smooth faces, are found imbedded in the soil on a barren piney woods hill, precisely as the quartz pebbles are imbedded in the drift deposits. From this place I obtained some of the largest and purest pieces that I have seen, probably fragments of a vein near by—some of them of the ordinary greenish gray colors, others a beautiful blue. From the same soil occasional tourmalin crystals may also be obtained, but they are not so common.

My own observations upon this belt have extended no further than this locality, about four miles south-west from Pinkston's, but I am informed that corundum has been found still further south-west, about four miles north of Dadeville.

Near the residence of Squire Wheeless, four or five miles south-west of Dudleyville, the soapstone beds have been extensively worked in former days. Associated with the soapstone is a massive rock, of light greenish color, with stains of metallic lustre; the texture is crystalline granular. This seems to be a tolerably pure hornblendic rock, and is very nearly like one analyzed from Hurst's, in Clay

county, in composition, general appearance, and in the association with soapstone. I give my analysis below:

Hornblendic Rock from Squire Wheeless', Tallapoosa county.

Composition.	
Silica	53.04
Ferrous oxide	8.35
Alumina	4.32
Lime	14.75
Manganese oxide	trace.
Magnesia	14.99
Potash	1.34
Soda	4.70
Combined water	0.76
Total	102.28

The percentage of soda is probably too high.

Specimens of corundum and associates, from Dudleyville and other places, have been placed in the hands of Dr. F. A. Genth, of the University of Pennsylvania, and those interested in the subject are referred to his masterly paper upon Corundum, its Alterations and Associated Minerals, published as No. 1 of the contributions from the Laboratory of the University of Pennsylvania.

Of the alterations of corundum described by him, specimens collected by me at Dudleyville exhibit most frequently the following: 1st, into spinell; 2d, tourmalin; specimens have been collected showing corundum surrounded by a shell of tourmalin, others show corundum penetrated by crystals of tourmalin; 3d, into damourite; 4th, margarite; 5th, associated with the corundum of Dudleyville, is "a soft bronze or brownish-yellow mineral, which is probably the result of the alteration of margarite, and still retains its form—lustre pearly." To this mineral Dr. Genth gives the name Dudleyite, and the analysis of the same, taken from the paper above referred to, is given below:

Analysis of Dudleyite (a new species).—Genth.

SiO_2	32.42
Al_2O_3	28.42
Fe_2O_3	4.99
FeO	1.72
MgO	16.87
Li_2O	0.19
Na_2O	1.52
K_2O	0.56
Ignition	13.43
	100.12

The interesting conclusions arrived at by Dr. Genth, from his investigations of corundum and its associated minerals in this country, are—

"That, at the great period when the chromiferous chrysolite beds (in part, subsequently altered into serpentine, &c.,) were deposited, a large quantity of alumina was separated which formed beds of corundum;

"That, this corundum has subsequently been acted upon and thus been changed into various minerals, such as spinell, fibrolite, cyanite, and perhaps into some varieties of feldspar; also, into tourmalin, damourite, chlorite, and margarite;

"That, a part of the products of the alteration of corundum still exists in the form of large beds of mica—(damourite) and chlorite—slates or schists;

"That, another part has been further altered and converted into other minerals and rocks, such as pyrophyllite, paragonite, beaurite, lazulite, etc."

Analyses of some of the rocks and minerals of this locality are in hand, and will be given in a future report.

The town of Dudleyville, which is about two miles from the corundum locality, stands upon strata of gneiss, into the composition of which a notable quantity of hornblende enters—it is, hence, a syenitic or hornblendic gneiss.

A geological section between Dadeville and Tallassee exhibits a succession of strata of hornblendic gneiss and

quartzites chiefly, striking in general north-east and south-west. South of the great chrysolite belt which bears corundum, synclinal and anticlinal folds are common. North of it, the strata dip south-east, with a few local exceptions, which, in so far as they have come under my observation, have been noticed above.

The red soils which result from the decomposition of these hornblendic rocks, are amongst the best in the State.

Analyses and full discussions of the typical soils of this region of the State, will be found in the agricultural part of a future report.

Occasional strata of talcose slates, or what have been called talcose slates, are found in the strata of hornblendic gneiss south of Dadeville. At Silver Hill, section 16, township 20, range 22, east, quartz veins in talcose slates have been worked successfully for gold, though such work has long since been abandoned. The same may be said of the auriferous mines of the vicinity of Long Branch and Blue Creek

Following our section southward, we cross a synclinal fold some miles below Walnut Hill. After crossing the Sougahatchie, and indeed before reaching that stream, outcrops of the crystalline rocks are seen only in the ravines cut by the creeks and their tributaries, the rounded hills being covered with the deposits of the modified drift —sand and pebbles—and timbered with a growth of pine and occasional black-jack oaks. The beds of soapstone and hornblende on Coon creek have been described in Tuomey's Report.

The steatite here differs in many respects from that associated with corundum near Dudleyville; it is massive, of granular texture, and light grayish green color. Enclosing this massive steatite are laminated beds of a rock very similar to it in color, hardness and other physical characters. A belt of "soapstone," occupying the same geological position, will be noticed in Chambers county, near Oak Bowery, and specimens from the two localities are identical in appearance. The fitness of the rock here

for the manufacture of various articles is shown by the traces left by the Indians.

Below Coon creek the strata, hornblendic gneiss, and occasional talcose schists, passing into gneiss at the Tallassee falls, all strike nearly north-east and south-west, and dip north-west.

Before describing the strata at and below the falls, I may mention that the same succession of rocks is found between Walnut Hill and Notasulga. Some miles south of the former place, the synclinal already spoken of is crossed, and below that the strata—chiefly hornblendic or syenitic gneiss—are seen dipping north-west. South of Sougahatchie, the hornblendic rocks pass into gneiss and mica schist, fine exposures of which occur at Ragan's mill, a few miles north of Notasulga. Just north of the mill, thick beds of gneiss are exposed, and here the passage from distinctly stratified gneiss into apparently massive granite may be seen to perfection. The outcrops of the granitic variety are smooth, rounded rocks, like the "flat rocks" of Chambers and Randolph. The ease with which blocks of any size may be quarried renders it peculiarly fitted for building purposes. Below the mill, a porcelain clay, resulting from the decomposition of the feldspar of the gneiss, has been dug in considerable quantities from the face of a bluff. The mica schists here become more quartzose, and assume the characters of itacolumite. A trap-dyke occurring near this place was noticed by Tuomey.

A comparison of the rocks exposed in the vicinity of Ragan's mill with those below Tallassee shows a great similarity in the kinds of rock, as well as their relative position to each other; and as Tallassee lies in nearly a south-west direction from Ragan's, the inference is that the same belt of gneiss, mica schist and itacolumite crops out at both places. Of this, however, I have no positive proof. I should not omit to state, however, that at Tallassee the strata strike nearly east and west, and dip

north, whilst at Ragan's the strike is north-east and south-west, and dip north-west.

Tallassee, which is one of the most attractive and picturesque spots in the State, has been well described by the practiced pen of Prof. Tuomey, and I have very little to add to what is found in his report. The section from the falls at the factory to the first or lowest falls, two miles below, I am enabled to give a little more in detail.

Commencing at the falls and going southward, we have—

1. Gneiss, forming the falls, passing, below the factory, into—

2. Itacolumite, some specimens of which are tolerably flexible. This rock is nearer the typical itacolumite than any of the strata to be seen at Ferrell's mill, in Macon county. Upon the bedding planes of this rock are frequently intricate and beautiful dendritic markings.

3. Gneiss, traversed by joints, the faces of which are often coated with crystals of quartz, and well defined crystals of black mica (biolite).

4. Arenaceous or quartzose mica schists, passing below into itacolumite.

5. Mica schists, with garnets—enclosing masses of a coarse-grained granite—the feldspar crystals of which are often a foot in dimensions, and of flesh red color. One of the most singular features of these schists is the large rounded boulders of quartz enclosed in them, and which, by the wearing away of the softer schists, are prominently exposed.

6. Mica schist (hydrous mica), with garnets, in some parts quartzose. Prof. Tuomey mentions nodules of pure graphite enclosed in this rock; but I was unable, after diligent search, to discover any pure graphite. The rock in question, however, encloses masses of a dark colored carbonaceous or graphitic slate, which resembles graphite in color, hardness, and in rubbing off on the fingers. It lacks, however, to a great extent, the metallic lustre of graphite.

7. Quartzose mica schists, thin laminated, and much contorted.

8. Mica schists.

9. Like No. 7.

10. Is a repetition of 5. The huge quartz boulders and projecting masses of coarse-grained granite forming conspicuous objects in the stratum forming the lowest falls of the river.

CHAMBERS COUNTY.

TOPOGRAPHY.

A prominent topographical feature of this county is the dividing ridge between the waters of the Chattahoochie on the east and the Tallapoosa on the west, which, entering this county near its north-east corner from Randolph, passes through it in a direction a little west of south, by Lafayette, to a point a little west of Oak Bowery. Thence it turns south of west, towards the Coosa, dividing the waters of Sougahatchie on the south from those of Sandy, Blue and Wind creeks on the north.

GEOLOGY.

Occasional granite, passing into gneiss—which in most cases, by the presence of hornblende, becomes more or less syenitic—together with frequent strata of quartzite, make up the great majority of the rocks of Chambers.

The soils derived from such hornblendic rocks have the deep brownish red color imparted by iron, and are usually fertile—under favorable circumstances producing well for a great number of years.

Steatite is also a rock of common occurrence in the county; localities will be given below.

Between Dudleyville and Lafayette, a geological section shows a succession of strata of gneiss, all more or less hornblendic, but varying greatly in the proportion of hornblende.

These rocks offer comparatively equal resistance to denuding agencies, and the face of the country is undulating rather than broken.

At Dudleyville the rock approaches gneiss in composition, the crystals of hornblende being few in number, though the red color prevails in the soil. For four or five miles, on the road to Lafayette, varieties of hornblendic rocks, cut by frequent veins of quartz. The strike is east north-east and west south-west, and the dip south south-east. Beyond this point the same strike prevails, but the dip is north north-west, showing that a synclinal axis is crossed.

Near Lafayette the strike of the rocks is north-east and south-west, and dip north-west, and Rev. C. D. Smith has mentioned the occurrence of a trap dyke between Dudleyville and Lafayette. Beyond the last named town, towards West Point, the same rocks are found, with a dip generally south-east. Wherever hornblendic rocks make the country, the prevailing forest growth is oak, and nowhere can one see a more luxuriant growth of red, black, Spanish, white and post oaks, than upon the undulating red lands of Chambers.

Strata of hornblendic gneiss, striking north-east and south-west, and dipping north-west, are seen for two or three miles north-west of Lafayette, on the road to Milltown. A narrow belt of sterile land, with light gray sandy soil, covered with quartz fragments, and timbered with pines, lies between this and the next outcrop of hornblendic rocks, about four miles from the town. These rocks strike nearly north and south, and dip west. Another belt of sterile land, and gneiss again, with a dip, however, of 10°–15° south-east. The point at which the synclinal is crossed here is about six or eight miles north-east of where the same or a similar fold was crossed between Dudleyville and Lafayette.

In section 12, township 23, range 25 east, is a rock mill, owned by Mr. William Jackson. Mr. Jackson has for many years been engaged in the manufacture of mantels, grave stones, etc., from steatite and some of the associated rocks. Near the mill are extensive outcrops of these rocks, one of the most striking of which is a green horn-

blendic schist full of brownish red garnets an inch in diameter. Slabs prepared from this rock have a mottled appearance, red upon green, which is attractive to some purchasers. They command a better price than those from the greenish gray steatite, with interlacing tufts of actinolite. This latter rock is similar to much of the steatite near Dudleyville, and from its geographical position, probably belongs to the same belt.

Associated with these is a chloritic schist, with large crystals or plates of chlorite filling cavities. The softer parts of the steatite have been worked here in former times by the Indians, and these traces may yet be seen in the fragments of broken utensils, and in the marks of the cutting instruments upon the rock itself.

Mr. Jackson is working at present chiefly upon headstones and monuments. Some of the pieces are really very good, though much of the rock lacks uniformity of color and texture. By careful selection, good pieces of large size may easily be obtained. The soft, easily worked steatite takes a very good polish, and mantels made from it are almost, if not quite equal in beauty to those made from the more costly marble.

Other localities of this valuable rock will be found elsewhere in the details of the several counties, and some of its applications will be given in the chapter upon economic materials and minerals.

In the vicinity of the mill the country is somewhat barren; beds of sand, with angular fragments of quartz, prevail.

A few miles south of Milltown is an extensive exposure of granite, which has been well described by Prof. Tuomey. Near the town, strata of hornblendic gneiss are seen again—strike north north-east and south south-west, and dip 45° east south-east.

North of Milltown for some distance our road passes over beds of quartzite as shown by the numerous fragments of that rock; then the red soil indicates hornblendic rocks below, though they do not come often to the surface.

About four miles south of Louina the rocks become more closely laminated, nearly vertical, much decomposed, and are frequently cut by veins of quartz. Crossing High Pine creek, the washes by the road side exhibit a light pink colored loam full of angular fragments of quartz.

The disintegrated slates, which are scarcely more than stratified clays, the undulating country, all are marks of the gold region. These deposits, however, are not now worked. At the top of a slight elevation, I noticed an outcrop of a soft black carbonaceous slate, which has been used for lubricating purposes, and answers well. It is similar to the black slates noticed above in Randolph and Clay counties. The powdered slate is readily burned white or gray before the blow-pipe. The continuation of this section into Randolph has already been given.

From the Randolph line south of Roanoke, on the Fredonia road, the same sterile country, with light gray soil, deep beds of sand and pine growth, described on the route from Lafayette to Milltown, is entered again. Six miles south of Roanoke, an outcrop of hornblendic gneiss, with north-east and south-west strike and a slight dip north-west, shows that the synclinal line has been crossed. Beyond this are very few outcrops, and the country is comparatively level to within four miles of Fredonia, where a strata of gneiss is exposed. This rock, with alternations of hornblendic gneiss, occurs at intervals as far as Fredonia and beyond. In several places where the gneiss is seen it approaches granite in its smooth, level exposures, which show little traces of stratification.

Half a mile from Fredonia, towards West Point, strata of hornblendic gneiss, striking north-east and south-west, and dipping south-east. The change in the dip from north-west to south-east occurs not far from Fredonia.

From this place to West Point, hornblendic gneiss, and occasional beds of gneiss make the country. On Ocalichee creek these rocks are finely exposed.

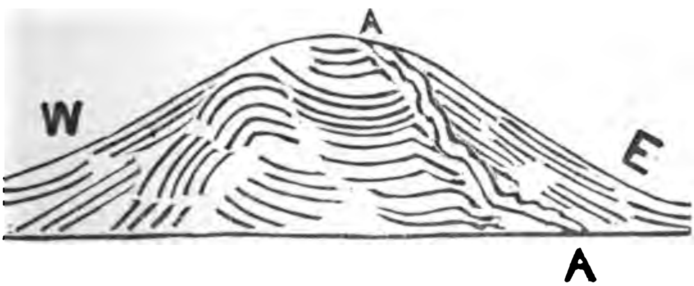
In the depressions between the low hills, I noticed in many places a sort of surface deposit of brown loam, with

a stratum of angular fragments of quartz at the bottom. This stratum of pebbles lay upon the edges of the now much decomposed beds of hornblendic gneiss, with the brown loam above it, the bed of loam being thicker in the depression and thinning out both ways towards the tops of the hills, as shown in the figure:

Similar occurrences are frequent further south.

The country between West Point and Oak Bowery is interesting, from the great number of folds into which the strata have been bent, and the amount of decomposition to which some of the rocks have been subjected.

The time has not been sufficient for me to trace out in detail any of these folds, and I can now only give my notes made in passing. About four miles west of West Point, outcrops of hornblendic gneiss were observed, striking nearly north and south and dipping west. The same rock was noticed, with occasional strata of gneiss, as far as Cusseta, striking generally north and south and dipping west; but near the latter town, striking west of north and east of south, with dip south of west. In some of the railroad cuts, curious contortions of the slates were observed. The accompanying figure will show the state of things in one place.



A tortuous vein of quartz, *a*, is exposed on both sides of

the cut. The lines in the figure represent the directions of some of the principal layers of hornblendic gneiss, which have undergone much decomposition, being sometimes changed into red clay.

Between Cusseta and Oak Bowery, the road passes over a series of small hills of hornblendic gneiss, the strike of which is nearly north-west and south-east, whilst the dip is both north-east and south-west.

Instances of contorted slates similar to that figured above are numerous. Occasionally the slates are seen bent up into a sort of shell which in the space of a few yards, shows a dip varying from north-east through east, south-east, and south, to south-west.

The weathering of granite in concentric shells has often been noticed. One has only to imagine such concentric shells, re-produced on a grand scale, in order to have an approximate idea of the phenomena here presented.

In section 26, township 21, range 27, east, near Mr. Sims', a vein of quartz is exposed in which are many large and well cut crystals of quartz. From the wearing down of this vein the crystals are detached, and thousands of loose crystals may be gathered from the red soil.

The filling in of the depressions between hills with a stratum of angular quartz fragments, covered with a bed of loam, similar to that figured above, is of frequent occurrence in this part of the county.

East of Oak Bowery, beds of excellent soapstone have been mentioned by Prof. Tuomey. West of the village, also, are several outcrops of the same rock. At Mr. Billingslea's, it has been quarried and worked into blocks for lining kilns for lime burning, and I am informed by Mr. A. L. Clapp that it answers this purpose admirably.

About one and a half miles south of the Bowery, on the road to Opelika, mica schists with garnets are seen, striking north-east and south-west and dipping north-west. These are succeeded by a narrow belt of hornbledic gneiss, then mica schists again in great force. All have the north-east and south-west strike and north-west dip. Near Opelika the mica shists are fine grained.

LEE COUNTY.

TOPOGRAPHY.

The ridge which has already been described as passing through Chambers, by LaFayette towards Oak Bowery, and thence south-westward into Tallapoosa, sends off another branch southward or south-eastward towards Opelika, in Lee county. Mt. Jefferson, on this ridge, is 840 feet above the Atlantic, and Opelika 850 feet. From Opelika a ridge turns westward through Auburn and Loachapoka, whilst that from Mt. Jefferson and Opelika is continued southward into Russell. The north and south ridge divides the waters of the Chattahoochee from those of the Coosa; whilst the east and west ridge separates the Chewacla, Ufaupee, &c., south from the Sougahatchie and its tributaries, north.

The causes of these topographical features can only be indicated in this place—a fuller discussion of them must be reserved for a future time, when more data shall have been collected bearing upon this point.

GEOLOGY.

The geological formations represented in Lee county, are the archaean in the northern part, and the modified drift which overlies it in the south.

My observations in this county have been too limited for me to attempt here more than an outline of its geological features.

Between Opelika and Yongesboro, the slates exposed by the railroad cuts are much contorted and decomposed. In one cut, where the contortions of the slates were less, the strata were observed striking north-east and south-west, and standing nearly vertical.

South of Yongesboro, in section 27, township 19, range 27, east, at the Chewacla mill, thick beds of peculiar syenitic gneiss, almost massive, occur, striking north-east and south-west. At this place, it was not easy to make out the direction or angle of the dip, on account of the thickness of the beds; but a similar rock seen at several points south-west of this, showed a dip of 85° or more north-west. This rock is porphyritic from large lenticular, and long flattened masses of reddish feldspar (orthoclase) imbedded in a greenish, almost black matris of fine grained hornblende. Black grains of mica (biolite) frequently surround the masses of feldspar, and from their parallelism often give a stratiform character to the whole. The mica, however, is less abundant than the hornblende, the main mass of the rock being made up of the feldspar and hornblende.

Millstones have been made of this rock, which is very tough.

The dam across the headwaters of the Little Uchee is built upon this rock, and although the quantity of water is small, the fall is considerable—the overshot wheel of the mill having a diameter of forty-six feet. A much greater fall could easily be had here if desired.

Near the mill the sand beds and pebbles of the modified drift cover the elevations, and broken fragments of the ferruginous sandstone which seems to be peculiar to the drift, cover the summits of some of the little hills. This sandstone is formed of grains of sand, and often pebbles, cemented together with hydrous ferric oxide, and it is usually found on the sides and near the summits of hills made up of materials of the drift. It will be more particularly noticed at a future time.

In a slight depression between hills of the drift, limestone, or rather, dolomite occurs in section 4, township 18, range 27, east. At this place the works of the Chewacla Lime Company are situated. The quarry is the same as that described by Prof. Tuomey as Yonge's quarry. He says, in speaking of this bed, "it is nearly horizontal, and appears to be the top of one of those flexuces so common

in the rocks of this part of the State; for the strata dip to the right and left of the trough-shaped depression in which the limestone is found."

At the time of Prof. Tuomey's visit, the limestone had been quarried to the depth of 25 or 30 feet—the first ten or fifteen feet of the excavation being through a red clay full of quartz fragments—then, for 10 or 15 feet, through the limestone, which is very much cut up by fissures. At this depth a sort of horizontal floor, or natual division, may be observed. Below this, however, the quarry has been extended thirty feet or more, since Prof. Tuomey was here. The limestone below is more compact, but any determination of stratification is difficult, if not impossible, from the numerous joints which traverse the rock in almost every direction. As to the position of this limestone with reference to the other rocks of this vicinity, I am inclined to believe that it lies south-east of an anticlinal fold, but very nearly the summit. These relations are much better seen at Wright's mill, some miles south-west.

From the Chewacla quarry, three tolerably well defined varieties of limestone are obtained:

No. 1. A moderately fine grained, bluish crystalline limestone, which is far more abundant than the other varieties. Its composition is—

Carbonate lime	59.23
Carbonate magnesia	36.34
Iron and alumina	3.34
Insoluble (mica, &c.)	1.03
Organic matter	trace.
	99.94

No. 2. A compact white variety, with a slightly yellowish tinge, of conchoidal fracture. This occurs less abundantly, but occasionally in large masses. Its composition is—

Carbonate lime	58.29
Carbonate magnesia	38.15

Iron and alumina	.86
Insoluble (mica, &c.)	2.24
Organic matter	.55
	100.09

No. 3. A dark blue crystalline variety, with a coating on joints, &c., of a black talcose mineral. It breaks with very uneven fracture, and is found in irregular seams of varying thickness. When burned it makes the very best, and the whitest lime. Its composition is—

Carbonate of lime	49.72
Carbonate of magnesia	32.03
Iron and alumina	0.27
Insoluble (mica, &c.)	17.44
	99.46

Specific gravity........................2.75

Analyses of Nos. 1 and 2 have been made by Professor Stubbs—of No. 3 by myself.

Veins of quartz of varying thickness, from one inch to a foot or more, are found occasionally cutting the limestone, and fragments of these veins, which may accidentally find their way into the kilns, sometimes escape notice, notwithstanding the care with which the burnt lime is looked over preparatory to putting up in barrels.

Fine crystals of calcite, quartz, and barite, have been found lining some of the cavities in the limestone. These crystals are generally associated more or less closely with the quartz veins.

The quarry, though so deep, is seldom flooded, for the water is drained off through a subterraneous channel.

About one hundred yards from the southern edge of the quarry, and ten feet or more higher, is an outcrop of a coarse grained crystalline dolomite of a yellow or cream color. My analysis of this dolomite shows the following composition:

Analysis of Dolomite from New quarry, Chewacla Lime Works. Coarse granular crystalline dolomite, showing glittering cleavage faces; cream color, powder white; dissolves readily in acid, leaving residue with scales of mica.

Specific gravity........................2.89.

Carbonate of lime	57.73
Carbonate of magnesia	41.58
Ferric oxide and alumina	0.12
Siliceous matter (mica, &c.)	0.89
	100.32

The extent of this rock has not yet been made out, but the superintendent, Mr. A. L. Clapp, expects to commence quarrying it for the kilns during the winter.

One hundred and fifty yards west of the quarry, limestone is struck at the depth of 45 feet; at three hundred yards distance it was not reached at all in a well from which a good supply of water was obtained.

The Chewacla Lime Company was chartered in 1851; at that time the lime was hauled to Columbus, 23 miles distant, and sold at 50 cents per bushel. The first kilns were rudely constructed, and their capacity was 20 barrels of 2½ bushels per day.

In 1867 the present superintendent, Mr. A. L. Clapp, took charge. Three kilns were constructed on Page's patent; the important feature of the patent being the evaporation of water in shallow pans under the grate bars, by which they are kept cool, and in virtue of which they last many years. Another shallow pan with water, under the whole length of the grate bars, receives and extinguishes all the cinders falling through the bars. The constant supply of vapor to the kilns, it is claimed, gives a better quality of lime, prevents sootiness, &c.

Two of the kilns are built of blocks of the porphyritic syenitic gneiss, from the vicinity of the mill; the third is built of brick, but is inferior to the others. The linings of

two of the kilns are of New Jersey fire-brick; of the other, a soapstone obtained from Mr. Billingslea's, five miles west of Oak Bowery. This is a greenish crystalline granular rock, cutting quite easily. The blocks were shaped at the quarry and hauled to the kilns. When the blocks are cut so as to present a cross section of the grain or bedding to the fire, they form, in Mr. Clapp's opinion, the best fireproof material that he knows. If the bedding planes, however, are exposed to the fire, the rock is likely to flake off after a while. Mr. Clapp made the mistake of getting out his blocks rather too large, and a few of them have been cracked from the strain in expansion. He will soon line the other two kilns with the same material. It is gratifying to know that in the soapstone, of which there are so many large beds in this part of the State, we have such an excellent fireproof material.

Under Mr. Clapp's superintendence, a narrow guage road has been built from the kilns to Yongesboro station, on the Columbus road, a distance of 3¼ miles, by which the cost of transportation of the lime to the railroad—275 barrels per day—is only $4.00.

The cost of the lime per barrel of 2½ bushels is $1.00 at the kilns. The present capacity of the kilns is 275 barrels per day. In the machine shops connected with the works the barrels are manufactured.

The air-slaked lime is sold for agricultural purposes at 15 cents per bushel. Mr. Clapp has shown practically its value as a stimulant. Five years ago he commenced the cultivation of the old worn-out fields around the kilns—then they produced about eight bushels of corn to the acre. In consequence of a judicious system of deep plowing, application of lime, turning in of green crops, returning to the soil the cornstalks, ground cotton seed, &c., and a rotation of crops, the yield of these fields this year has been 38½ bushels to the acre; and this upon land which had been thrown away as too much worn out to cultivate.

The depression in which the limestone just described occurs continues towards the north-east, and outcrops of

the rock have been noticed at several points. None of it has, however, been utilized except at the Colquit quarry, and no work has been done here for many years. The quality of the rock is the same as that of the Chewacla limestone.

About two miles north, or a little east of north, of this place, and apparently not forming a continuation of the beds which have been worked at Colquit's and the Chewacla quarries, is a bed of limestone, which was discovered a few years since. So far as exposed, this limestone has been much water worn; considerable caves are found in it; and it is frequently the case that masses of limestone are separated by large fissures, which have been filled in with red clay. The probability is that it will be found to be more compact further from the surface. The limestone itself is a blue crystalline rock, with occasionally a good deal of pyrite. On the south it is succeeded by argillites, much contorted in their bedding. When this slate has been long exposed, it is much decomposed, and looks and cuts somewhat like soapstone. The first kilns here were the old fashioned pot kilns dug into the slates. Another kiln, a hundred yards off, has been constructed upon a better plan, and a considerable quantity of lime burned. This lime appears to be of a different quality from that obtained from the dolomite of Colquit's and Chewacla quarries. At present no work is going on at this place, which is the property of the Springvilla Lime Company.

North-east of this place no occurrence of limestone has been noticed.

The Springvilla limestone gave me upon analysis the following composition:

Analysis of limestone from Springvilla quarry, Lee county.

Specific gravity........................ 2.91

Carbonate lime	72.94
Carbonate magnesia	22.52

Iron and alumina	0.7
Siliceous matter	3.9
	100.1

In the little valley where the dolomite occurs, crystals of quartz, of great clearness and beauty of crystalline form, are frequently found. They are usually found loose in the soil, being derived, no doubt, from the quartz veins in limestone, which has disappeared by denudation, leaving the indestructible quartz. The sharpness of the crystalline forms is striking, when one considers the circumstances under which they are found.

Between the Chewacla works and Auburn, the drift is found covering most of the elevations. Some exposures of crystalline rocks may be seen where these surface deposits have been removed by denudation.

Two or three miles from the kilns, beds of laminated micaceous sandstone were noticed, striking north-east and and south-west, and standing nearly vertically, but with a slight dip south-east. Beyond this is crossed a ridge covered with drift deposits on the summit, whilst in the depression below angular fragments of quartz are numerous.

Four miles from the kilns the road crosses an outcrop of porphyritic syenitic gneiss, analogous to that observed at the Chewacla mill. The strike was north-east and south-west, and the dip 85° or more south-east. Beyond this the porphyritic rock is succeeded by mica schists, alternating with strata of syenitic gneiss, which show a tendency to break up into rounded and prismatic pieces, like logs and chips of wood. West of this, purple colored mica schists, much decomposed, and in places changed into stratified micaceous clays.

The prevailing strike was north-east and south-west, and after passing the porphyritic rock the dip was north-west at first nearly vertical, but going westward the angle of inclination decreased. It will be seen below that this corresponds very well with what was observed at Wright's

mill, where the porphyritic rock occupies very nearly the axis of the anticlinal.

Between Auburn and Wright's mill, in section 18, township 18, range 26, east, the geological section is a repetition of that just described between Auburn and the lime kilns, viz., alternating strata of hornblendic gneiss and mica schist, striking north-east and south-west, and dipping north-west, the angle of the dip increasing towards the south—the strata at the mill being vertical—and beyond the mill dipping south-east.

The rock at the mill is the thick bedded porphyritic syenitic gneiss, which has already come under our notice; it is almost massive, and very tough.

The tributary of the Chewacla creek, which turns the large wheel of the mill, (42 feet in diameter), cuts through, or rather falls over, the thick beds of this rock. In the bed of the creek below the mill the edges of the strata which succeed the porphyritic rock are finely exposed. First, stratified quartz fifteen feet thick, nearly vertical, but with a slight dip to the south-east. This stratum is cut by a series of joints, the strike of which is north and south, and the dip 85° west. The intersection of these joints with the planes of stratification causes this rock to break up into smooth-faced rhomboidal fragments.

Next comes a repetition of the porphyritic rock, but much more evidently laminated, and in much thinner beds than the first.

Then heavy beds of laminated sandstone resembling itacolumite, also dipping south-east at a high angle, completes the series of rocks exposed here.

Half a mile west of this place another tributary of the Chewacla, flowing from the north, falls over the same porphyritic syenite, and cuts through the other strata just mentioned.

Some beautiful opaque yellowish gray crystals of quartz, showing chiefly the double pyramid, have been found here. They are probably the variety ferruginous quartz, though much higher colored and grayer than ordinary.

A few hundred yards south of the laminated sandstone or itacolumite, is the exposure of limestone described an analyzed by Prof. Tuomey. The composition is that of dolomite, the same as that at Chewacla. The quarry here formerly worked by Col. Echols, has long since been aban doned.

Following the Chewacla north-east, numerous outcrop pings of this limestone may be seen. At Mr. Reese's ther is an old quarry, now abandoned, I believe. A mile o more from Wright's mill, at Ogletree's, the same rock i exposed, higher, however, above the water level, and con sequently more convenient for quarrying.

In Tuomey's Report may be found one analysis of thi limestone, or dolomite, from Echols' quarry, and two fron Reese's.

The following section between Auburn and the limestone bed may make the geological structure clearer than a written description can:

1. Mica schists.

2. Hornblendic gneiss.

3. Porphyritic syenitic gneiss.

4. Laminated quartz.

5. Laminated micaceous quartzite, (itacolumite).

6. Limestone.

a. Granitoid gneiss, with flesh-colored orthoclase and black mica, (biolite).

The section is extended beyond Auburn—for several miles—showing mica schists, succeeded by granitoid gneiss, with very little traces of bedding, and showing smooth weathered expanses, similar to the granite of Randolph, Coosa, &c.

This is probably the same as the granitoid rock described near Ragan's mill, north of Notasulga.

South-west of Wright's mill, I know of no other outcrops of the limestone; but two or three miles from Vaughn's mill (formerly Ferrell's) several bold limestone springs occur, which furnish the greater part of the water utilized by that mill. It is highly probable that careful exploration would show the existence of the limestone continuously from Colquit's quarry, south-west to this place, a distance of 18 to 20 miles. Below this, however, the drift deposits cover the underlying crystalline rocks to a great depth, so that outcrops of the latter are very seldom seen.

At Vaughn's, or Ferrell's mill, near section 30, township 18, range 15, east, the beds of stratified quartz are of considerable thickness. A great part of these rocks is a banded jasper, which is intersected by joints, which cause it to break up into rhomboidal pieces. The strike of the beds is north-east and south-west, and the dip south-east. Very little, if any, mica can be detected in this rock, which resembles the stratified quartz exposed in the bed of the Chewacla creek below Wright's mill.

Between this point and Notasulga, the drift covers the country, and it is only where the streams have cut through the surface covering that an occasional outcrop of crystalline rocks is seen.

The only outcrop of this sort which I noticed on the route was of mica schist.

From Prof. W. C. Stubbs, who visited Columbus, Ga., at my request, I have received the following description of the crystalline rocks of that vicinity: "Just opposite the Eagle and Phœnix mills, in the city of Columbus, the Chattahoochee river tumbles over an immense bed of rock, forming what is known as the falls. The rock immediately at the falls is mica schist, greatly tilted, striking north-east and south-west, and with here and there large boulders or massive blocks of a dark gray rock, very hard and compact.*

*Upon examination this rock is found to be a granular crystalline compound of feldspar, with a little laminated *hypersthene*. The feldspar is

"Below the mills, on the Georgia side, the bed of the river is of a hard, firm rock, varying from mica schist to granite, while on the Alabama side, and above the bed of the river, are large beds of feldspathic granite, very soft, crumbling easily under a slight blow of the hammer, and varying in color from green to pink. Just below the Mobile and Girard railroad bridge, the rocks all strike east and west, and become of a schistose character. Here they continue gradually to assume their natural direction of stratification, until we reach a point about three hundred yards below the bridge, where we find the last indication of granitic rocks on the line of the river. The general direction of the strike here is north-east and south-west.

"Five hundred yards below the bridge no rocks are visible and the soil is entirely alluvial. Following the river for over five miles, we could see no further traces of the metamorphic rocks. Coming up from the river, and following the course of the Mobile and Girard railroad, we could see no indications of crystalline rocks after we had passed the four-mile post. I was informed by the section master of this road that the first indication of cretaceous limestone was at or near Seale's station.

"It is my opinion that the city of Columbus marks very nearly the south-eastern boundary of the metamorphic rocks in Alabama."

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of partly yellowish white color, greasy lustre, striated on cleavage planes, and partly of dark bluish color, with the peculiar changeable colors of labradorite. The specimens show also the presence of a small quantity of black mica (biotite). I have detected no quartz or other mineral in them. The rock has therefore the composition of a norite or hypersthenite, and it is from this occurrence that I have said above that the Norian (Labradorean or Upper Laurentian) series of rocks is represented in Alabama. I have not examined the locality personally, and make this assertion with hesitation. Perhaps the rock in question may be part of a dyke. It appears from Prof. Stubbs' description that the norite lies *unconformably upon* the mica schist. Further examinations in Georgia, in the continuation of this belt of rocks, would probably settle the question. E. A. S.

ELMORE COUNTY.

Observations in this county have been confined to the lower portion, between Tallassee and Wetumpka, and thence westward to the Autauga line.

From Tallassee to Wetumpka and beyond, to within half a mile of Elmore station, on the South and North Alabama railroad, there is an almost level pine barren. At the latter place the usual rolling drift hills begin. In the level pine barrens, beds of sand are numerous, whilst the rounded pebbles are few. With the undulating country, however, the pebbles increase in number; the edge of a great pebble stream is reached at Robinson Springs. This subject will be taken up again in a future report, and it only remains to mention a few occurrences of crystalline rocks upon the route indicated.

The beautiful laminated sandstone, sometimes flexible, which has been noticed at Tallassee, may be seen again at Blankston's mill, some miles west of the former place, and it is difficult to find better specimens of the rock in question than those here.

About eight miles from Wetumpka, near Mr. Townsend's, a porphyritic mica schist is exposed, near the banks of a little stream. Then about one mile from Wetumpka the mica schist which forms the falls of the river may first be seen. The strata exposed between Tallassee and Wetumpka strike east and west and dip towards the north. At the latter place, as well as the former, the same strike and dip prevail.

The crystalline rocks of Elmore and the lower part of Coosa require a much closer study than has as yet been bestowed upon them, but I hope in a short time to give the most important details of the geological structure of this part of the Archæan region of the State.

III. ECONOMIC MATERIALS.

Building Stones.—For architectural purposes, there are few rocks which can compare with *granite*, a belt of which varying in breadth traverses the metamorphic regions from the Coosa river, near the mouth of Chestnut creek, to the Georgia line in Randolph. In several localities this rock has been quarried for building purposes: the inaccessibility of the outcrops, however, has stood in the way of its extended use.

Mr. Graham's quarry, near Bradford in Coosa county, has already been specially mentioned; and though that has been, perhaps, more extensively quarried, yet I have the authority of Mr. Graham, who has carefully explored this section, for saying that fifty square miles of granite are exposed in this belt.

Gnesss, when it occurs in thick beds, is also an admirable building material. The gneiss near Ragan's mill, north of Notasulga—that near Auburn, and at Tallassee, have all been utilized for this puipose. At the latter place, the factory is built of gneiss furnished by the quarries close at hand.

A *porphyritic hornblendic gneiss*, in Lee county, has been used with advantage in the construction of the Chewacla lime kilns. It is an exceedingly tough and durable rock, and, as it is found over a considerable area, will doubtless some day come into more general use.

Norite or *hyperthenite*, a tough, granular rock, having somewhat the appearance of granite—for which it is often mistaken—is second to none in beauty and value. The only occurrence of this rock with which I am acquainted in Alabama is near Columbus.

For *millstones*, the granites, gneisses, and the porphyritic rock just mentioned, have been used. In several places along the granitic belt millstones have been regularly manufactured:

Marbles.—Prof. Tuomey early called attention to the fine quality of the marble which is found in the north-western limit of the metamorphic region. Besides the establishments for the working up this material, mentioned by him, I know of no others since gone into operation. His analyses or two accompanying this report show the purity of this marble.

Materials for lime burning.—The dolomites of Lee county have long been celebrated for the excellence of the lime produced from them. This dolomite has been discussed in some detail in the geology of Lee county.

Soapstone.—This valuable rock is found in many localities in our region of crystalline schists, in Clay, Tallapoosa, Chambers, &c. The great number of old excavations along these soapstone belts, show that the Indians made extensive use of it in the manufacture of pottery, &c. Fragments of broken utensils, and traces on the rock from which such utensils have been cut, are frequent wherever these excavations are found. There is a wide-spread belief that they have been made in search of precious metals, and in one instance, at least, a company was formed and much money expended in mining for silver, at one of these Indian excavations; it is needless to say with what result.

Much of this old work is popularly ascribed to De Soto, as are also excavations in the mica regions.

Mr. William Jackson, of Chambers county, has for a long time been engaged in working up this material, chiefly into head-stones and monuments. For mantels and smaller articles it would answer well, and it deserves to come into more general use. As a fire-proof material, a practical trial of it has been made at the Chewacla lime kilns—and it has been found equal to the New Jersey fire-brick. In cutting the blocks, however, care must be taken to shape

them so that a cross-section of the grain may be presented to the fire.

Soapstone has, as yet, found very limited use with us, but its applications in the arts are manifold; in the manufacture of porcelain, linings of boilers, fire-places, &c., for culinary utensils, for rollers in cotton factories, &c., &c., whilst for the floors of baker's ovens it deserves special mention.

For the Manufacture of Glass and Porcelain.—The fine white porcelain clay from Randolph county, near Louina, was mentioned and analyzed by Prof. Tuomey. Similar beds may be found in many other places on the borders of the granitic belt—thus, near Socopatoy; also, near an outcrop of granitic gneiss near Notasulga. For the manufacture of *glass*, the white pulverulent quartzite in Chilton county is the best material I have seen; yet comparatively pure quartz may be found in large quantities in numerous localities—in Chambers, Randolph, Lee, Clay, and other counties.

Asbestos.—In the vicinity of the corundum deposits of Tallapoosa county, asbestos is found in considerable quantity. Its use in fire-proof compositions is well known: for this, however, inferior qualities answer very well. Recently renewed attempts have been made to incorporate asbestos into textile fabrics, by weaving the fibre together with cotton or wool. For such purposes, of course, none but the finest qualities of asbestos, with the longest fibres, are suitable. There has been as yet no demand in this State for this mineral, which has consequently never been regularly mined, and it is impossible to say what our resources are in this particular.

Mica.—From Randolph county, south-west to Chilton, along a belt of mica schist, occur many old excavations in beds or veins of a coarse grained granite. The numerous large plates of mica about such mines have often attracted attention, and in many instances there are traces of subsequent work. Very good plates of mica have been found in Randolph, Clay, (near Delta and Ashland,) and Coosa;

but in Chilton county the best specimens have been obtained

The mica is found in large "boulders," in the language of the workmen. These are split up, and the plates trimmed to marketable sizes. The best mica will command from 50c. to $3, according to the size of the plates. It is used for the manufacture of lamp shades, for stoves doors, window frames, &c.

Corundum.—The mode of occurrence of this mineral has been given in the details of Tallapoosa county. Its extreme hardness, which is next to that of the diamond, fits it for abrasive purposes, for polishing metals, &c. The varieties are—(1). *Sapphire,* which includes the purer kinds, transparent, of bright colors, used as gems. None discovered as yet within our State. (2). *Corundum,* the ordinary kinds, opaque, of dull colors, blue, red, gray, brown, to black. Being pure alumina, it is superior in hardness to emery; and when ground it is used as a polishing material. The only locality as yet known in Alabama, is from Dudleyville, Tallapoosa county, ten or fifteen miles south-west. Fragments of corundum are found at intervals for this distance, yet the position of the beds or veins is made out only in one or two instances. (3). *Emery* includes the granular varieties, dark gray to black colors, usually intimately mixed with magnetic iron, or hematite. I have not seen any specimen of emery from Tallapoosa county.

Graphite is found disseminated in small quantities in the rocks in several counties. It impregnates certain mica or clay slates, in Clay, Tallapoosa, Randolph, and Chambers counties, to such an extent as to fit them for lubricating purposes.

In several places a black graphitic powder or mud has been mistaken for the black ore of copper.

In Chilton county, tolerably large irregular masses of pure graphite are found in a mica schist. Though the extent of the graphite deposit there is not fully known, yet there is every reason to believe that it is considerable. The

value of this material makes it desirable that the Chilton county occurrence should be thoroughly explored. Its uses in the arts are well known, the most extended being perhaps for the manufacture of pencils; also employed to diminish friction in heavy machinery; in the manufacture of crucibles; for stove-polish, &c.

Gold.—Mining for gold is carried on in very few places in Alabama at present. One mill near Arbacoochee, another at the old Pinetucky mines, and another near Chulifinnee, are the only ones that have come under my notice. Surface deposits are still worked occasionally.

It is impossible to enumerate here all the localities in which gold has been found; indeed, there is scarcely a creek or branch, in that part of the metamorphic region lying north-west of the granite belt, from the gravels and sands of which gold may not be extracted. Occurrences south-east of this line are not so numerous as towards the north-west, yet they are by no means rare.

Gold mining in Alabama, with rude appliances, has probably seen its best days.

Silver.—I mention silver in this connection only because of statements so frequently seen concerning valuable silver mines in the metamorphic region. I know of no mines in this part of the State from which silver is obtained. Some mention of the Talladega and Tallapoosa "silver mines" will be found in the details of those counties. I will state here, however, that samples of five ores from Clay county, sent by a gentleman of Talladega to R. Longman's Sons, of New York, assayers, have been reported by them to contain from one and a half to three oz. of silver per ton of ore.

Tin.—I can find no authenticated record of discovery of tin ore in this region. For notice of *alloy* of tin, lead, and bismuth, discovered near Millerville, see under Clay county. Accounts of the occurrence of lead and bismuth seem to be based upon the same discovery.

Copper.—Although traces of copper had been discovered at several places in this region, as long ago as 1854, it was

not until the spring of 1874 that a lode of copper ore in sufficient quantity to justify working was found by Mr. Richard J. Wood, in Cleburne county. The principal ore at Wood's mine is a black earthy ore, which is called the black oxide, but which contains always a large proportion of sulphur; the other rarer ores are chalcopyrite, native copper, cuprite, malachite, and azurite; the pyritous ore below the black ore has not yet been worked. A fuller account of these ores will be found under Cleburne county.

The presence of copper in small quantities—south-west of Wood's mine, in several places in Clay and Coosa counties—makes it highly probable that other lodes of workable ore will soon be laid bare, especially, since the discovery at Wood's mine has given such a new impetus to the search for copper.

Manganese.—Regular deposits of manganese are not yet known in this region. Small quantities of manganese ores have occasionally been found associated with other metallic ores.

Iron Ores.—The chief ores of iron in the metamorphic region are magnetite, hematite, or specular iron—titaniferous magnetite, and limonite, or brown iron ore. These ores are found (with the exception of the last named) associated chiefly with the hornblendic rocks. In many instances they appear to be interstratified with these.

An analysis of magnetite, showing very little phosphorus, sulphur, or titanic acid, will be found in the details of Clay county. Titaniferous magnetites from Chambers have been analyzed by Prof. Mallet for Tuomey's Report. As yet, the time has not been sufficient for the analysis of the specimens callected last summer; but the discussion of these ores will be resumed at a future time.

Of the hematite, I have seen no extensive beds, but particles of specular ore are common in many of the rocks. I have little doubt that closer examinations will reveal valuable beds of this ore.

The limonites, in most cases, appear to be "gossans," *i. e.* the result of the decomposition of beds of pyritous ores;

an analysis of such an ore will be found under Coosa county. Deposits of this kind are not likely to be very deep, though the ores are often of fine quality. Of a different character, *appears to be* (I am not sure, however,) the bed of limonite occurring in Chilton county, in section 23, township 23, range 15, east, that near Candutchkee, and another several miles west of Candutchkee in Clay county.

Ores from the last named locality have been used to some extent in a bloomary; the others remain as yet undeveloped.

If we had not the extraordinary deposits of limonite in the valley north-west of the crystalline rocks, and the lenticular ores further north, both of which are far more accessible, the ores of the metamorphic region would still establish for Alabama the reputation of an *iron* producing State. Until, however, railroad lines shall traverse this section, or the rivers shall be opened to navigation, these deposits will probably lie untouched.

Pyrite.—The extensive beds of iron pyrites or pyrite in this State have never yet been utilized to any great degree. It is from this mineral that much of the sulphuric acid of commerce is manufactured. When the pyrite holds a certain per centage of copper, which is the case with the Spanish and English pyrite, and also with much of our own, its value is of course increased. Although the working of low grade pyritous copper ores for the *copper* alone might be attended with very little profit, yet when the *sulphur* also is utilized, in the manufacture of sulphuric acid, with the proper appliances, even a very small per centage of copper (from 4 to 6 per cent.) may be profitably extracted, and the residue of *iron* is itself a valuable ore.

The great importance of untilizing the sulphur, which is so often allowed to go to waste, cannot be too forcibly urged upon those interested in the working of ores of this character.

I need only point to the vast wealth accumulated by certain English companies in this very branch of industry to show that *it will pay.*

Copperas and alum.—Many of the slates and schists of this region are impregnated with pyrite, the decomposition of which produces alum and copperas.

Rutile.—This mineral, which is a form of titanic acid, has been found in considerable quantities in Baker county. I have seen, however, other specimens from Coosa, and it will doubtless yet be found in other localities. Its uses in the arts are limited; it is sometimes used to color artificial teeth.

IV. CHEMICAL REPORT.

I have thought it desirable to present a tabulated form, the results of the analyses of iron ores, limestones, coals, rocks, &c., thus far made. With regard to the methods of analysis, I have uniformly followed what I have considered the best, though often at the expense of much time and labor, deeming it much more important to have a small number of analyses accurately made than a large number of approximations. I take this occasion to acknowledge my indebtedness to Prof. N. T. Lupton and Prof. Wm. C. Stubbs for the analyses contributed by them to this report; and it is with pleasure that I announce that Prof. Wm. C. Stubbs, of the Agricultural and Mechanical College, has promised me in future his assistance in the chemical work of the survey.

In the tables below, the name of the analyst will accompany each analysis.

IRON ORES.

Method of Analysis.—In the analyses made by Prof. Lupton and myself, the methods pursued by the chemists of the Ohio Geological Survey have in general been followed. The iron and alumina have usually been separated by hyposulphite of soda (chancel), or by means of potash, pouring the solution *into the potash*, and not *vice versa*. The two substances have then been estimated gravimetrically. For the separation of the phosphoric acid, we have generally used the *nitric acid solution* of molybdate of ammonia, though in some instances the *aqueous solution*, as recommended by Parry.

The other ingredients have been estimated in the usual ways. For the determination of specific gravity, Jolly's spring balance is undoubtedly the most convenient instrument, giving at the same time sufficiently accurate results.

TABLE I.—IRON ORES.

HYDRATED SESQUIOXIDES (BROWN HEMATITES.)

NUMBERS.	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.
Specific gravity	4.31	3.61	3.78	3.81	3.03	3.14	3.67	3.40	3.75	3.56	3.43
Combined water	11.19	11.27	8.54	10.59*	7.16	7.51	10.90	9.79	11.35	12.14	11.55
Siliceous matter	3.09	13.49	3.34	3.06	1.61	40.62	9.26	1.78	2.46	12.16	2.98
Sesquioxide of iron	84.10	73.44	87.49	82.84	88.12	46.12	78.27	83.13	84.46	75.04	82.83
Alumina	0.27	1.03	0.27	0.35	1.35	1.85	1.65	3.67	0.91	0.30	1.39
Oxide of manganese	Trace.	0.00	0.12	0.95	0.02	0.29	0.50	0.19	0.33	0.00	1.02
Lime	1.02	0.38	0.82	1.02	0.40	0.39	0.44	0.50	0.26	0.41	Trace.
Magnesia	0.08	0.08	0.33	0.19	0.02	0.75	0.22	0.04	0.04	0.06	0.12
Phosphoric acid	0.20	0.33	Trace.	0.55	1.33	0.87	0.23	0.76	0.58	0.00	Trace.
Sulphur	0.46	0.28	0.48	0.45	0.20	0.07	0.03	0.61	0.14	0.14	0.14
Total	100.41	100.30	100.39	100.00	100.21	98.47	101.50	100.47	100.53	100.25	100.03
Metallic iron	58.89	51.43	61.27	58.01	61.71	32.30	54.81	58.21	59.15	52.55	58.01
Analyst	Smith.	Smith.	Smith.	Smith.	Smith.	Smith.	Smith.	Smith.	Lupton.	Lupton.	Lupton

*Water, 7.41. Loss, 3.18.

No. 1. Compact radiately fibrous brown hematite, outer service smooth, mamelonated, with reddish color, interior rough, more or less porous and ochreous. From Shelby county, five or six miles north-east of Montevallo.

No. 2. Compact brown hematite, breaking with smooth conchoidal fracture; moderately brittle; color of ore, light liver brown; of powder, yellow. From Shelby county, six miles north-east of Montevallo.

No. 3. "Pipe ore." Occurs in stalactitic, botryoidal masses; outer surface brown, affording cherry red streak Mass of ore, reddish brown, with dark red streak. From Bibb county, five miles west of Briarfield.

No. 4. Compact brown hematite, breaking with a smooth conchoidal fracture; color of ore, liver brown; of streak, yellowish brown; quite brittle. From Bibb county, five miles west of Briarfield.

No. 5. Porous ore, of brown and red colors, with iridescent tarnish in places. Streak, dull brownish red. From section 23, township 23, range 15, east, Chilton county.

No. 6. Yellow ochreous earthy ore, cut by veins of quartz; streak yellow. From section 23, township 23, range 15, east, Chilton county.

No. 7. Compact brown hematite, partly fibrous; outer surface mamelonated, covered with black glaze; interior compact and ochreous; streak, yellowish brown. Locality, Chilton county, section 23, township 23, range 15, east.

No. 8. A porous gossan, of irregular layers or shells of compact brown hematite, with similar shells of red hematite, the latter sometimes passing into a red powder. Cavities lined with small botryoidal masses of hematite, often iridescent. Occasional yellow ochreous masses are mixed with the brown layers; streak, dark red. Locality, section 9, township 24, range 19, east, Coosa county.

No. 9. Brown hematite. Exterior surface botryoidal, smooth, glazed, of reddish tinge in the depressions. A mixture of cellular, fibrous, and compact structure; streak. Locality, Tuskaloosa county, section 9, township 21, range 6, west, near Woodstock Station.

No. 10. Brown hematite. Exterior fibrous; remainder compact, with ochreous tinge; fracture of compact portion, smooth, conchoidal; streak, —. Locality, same as No. 9.

No. 11. Brown hematite. Structure, a mixture of cellular, fibrous, and compact; color, dark brown and ochreous; fracture, earthy; streak, —. Locality, same as No. 9 and No. 10.

TABLE II.—IRON ORES.

RED HEMATITE.

	1.	2
Specific gravity	3.86	3.43
Combined water	1.26	7.45
Siliceous matter	30.03	16.24
Sesquioxide of iron	60.79	70.39
Alumina	5.88	3.31
Oxide of manganese	0.14	0.26
Lime	1.58	0.94
Magnesia	0.36	0.31
Phosphoric acid	trace.	1.39
Sulphur	0.90	0.60
Total	100.94	100.89
Metallic iron	42.51	49.40
Analyst	Smith.	Smith.

No. 1. Compact laminated ore; brittle, breaking, with uneven fracture, into more or less regular cuboidal pieces; color and streak, dark red. The mass of the ore is dotted with transparent, imbedded crystals, of quartz. Locality, Iron Mountain, two miles north-east of Columbiana, Shelby county.

No. 2. Ordinary lenticular ore; color of streak, dull red. Locality: From Robert Casky, Springville, St. Clair county

TABLE III.—IRON ORES.

MAGNETIC ORES.

	1.
Specific gravity	3.85
Combined water	0.91
Siliceous matter	3.75
Ferrous oxide	25.88
Ferric oxide	57.52
Alumina	6.00
Oxide of manganese	6.24
Lime	trace.
Magnesia	0.00
Phosphoric acid	trace.
Sulphur	0.00
Titanic acid	0.00
Total	100.30
Metallic iron	60.40
Analyst	Stubbs

No. 1. Compact ore; easy fracture; brownish red powder. Locality: Near J. M. Kennedy's, Clay county.

TABLE IV.—IRON ORES.

BLACK BAND.

	1.
Specific gravity	2.42
Volatile matter	24.25
Siliceous matter	0.71
Carbonate of iron	62.35
Sesquioxide of iron	8.03
Alumina	1.18
Oxide of manganese	0.00
Carbonate of lime	2.75
Carbonate of magnesia	0.61
Phosphoric acid	trace.
Sulphur	trace.
Total	99.88
Metallic iron	35.75
Analyst	Lupt'n

No. 1. Black band ore; compact earthy; black, with reddish brown streak. Locality: ——. Sent by Mr. Mc-Ilwain.

COALS.

Method of Analysis.—In the four proximate analyses o bituminous coals given below, the moisture has been de-termined by exposing the finely powdered coal for one hour to a temperature a little above the boiling point o water; the loss in weight represents the moisture present In the determination of volatile combustible matter and fixed carbon, the method of Prof. Hinrichs, of the Iow Survey, has been adopted, viz: heating the pulverized coal for three and a half minutes over alcohol lamp (brigh red heat), and then, without cooling, for the same lengt of time, over a blast lamp (white heat).

In the estimation of sulphur, it is proposed, in future, t make separate determinations of the sulphur in the coa and that remaining in the coke.

The importance of such double determinations of sul-phur, in estimating the relative values of coals for ga making and for furnace purposes, is manifest.

Estimations of phosphorus, the presence of which ha been detected in some Ohio coals, will also be made in th analyses of Alabama coals which may be found to con-tain it.

TABLE V.—BITUMINOUS COALS.

PROXIMATE ANALYSIS, INCLUDING SULPHUR.

	1.	2.	3.	4.
Specific gravity	1.29	1.36	1.30	1.3
Moisture	1.96	1.59	1.12	1.7
Ash	2.79	5.45	7.53	3.8
Volatile combustible matter	43.09	38.32	36.17	35.4
Fixed carbon	52.16	54.64	55.18	58.9
Total	100.00	100.00	100.00	100.0
Sulphur	1.33	1.33	1.83	0.9
Analyst	Lupton.	Lupton.	Lupton.	Lupto

No. 1. Distinctly bedded, breaking into rectangular fragments, with iron pyrites disseminated through the seam in apparent layers, and on surface of fragments. Specimen taken had no pyrites adhering to surface. Locality: Randolph's mine, near Tuskaloosa.

No. 2. Laminated; breaks into rectangular fragments. No pyrites visible in the specimen, though in some portions of the seam it is found in considerable quantities. Locality: University mine, ten miles north-east of Tuskaloosa, on Warrior river.

No. 3. Bright smooth coal, from New Castle mine, in Jefferson county, about ten miles from Birmingham.

No. 4. Bright clean coal, not so distinctly bedded as specimens 1 and 2. Locality: Helena mines, Cahaba coal fields.

LIMESTONES.

Method of Analysis.—The usual methods have been followed.

TABLE VI.—LIMESTONES.

	1.	2.	3.	4.	5.	6.	7.
Specific gravity..	2.79	2.68	....	....	2.89	2.75	2.91
Siliceous matter..	2.95	4.65	1.03	2.24	0.89	17.44	3.93
Fer. ox. & Alum'a	*1.15	†0.75	3.34	0.86	0.12	0.27	0.73
Carbonate of lime	95.25	94.40	59.23	58.29	57.73	49.72	72.94
Carb. of magnesia	0.62	0.41	36.34	38.15	41.58	32.03	22.52
Total......	99.97	100.21	99.94	99.54	100.32	99.46	100.12
Analyst	Stubbs.	Stubbs.	Stubbs.	Stubbs.	Smith.	Smith.	Smith.

*Chiefly alumina. †Chiefly ferric oxide.

No. 1. White crystalline marble, from Taylor's mill, Talladega county.

No. 2. Blue marble, from Taylor's mill, Talladega county.

No. 3. Moderately fine grained, bluish crystalline limestone, from Chewacla quarry, Lee county.

No. 4. Compact white limestone (dolomite), with slightly yellowish tinge, of conchoidal fracture. Locality: Chewacla quarry, Lee county.

No. 5. Coarse granular crystalline dolomite, cream color. Locality: New quarry, Chewacla, Lee county.

No. 6. Dark bluish black—variety from Chewacla quarry—makes the best lime. Lee county.

No. 7. Crystalline bluish limestone (dolomite), Springvilla quarry, Lee county.

TABLE VII.—ROCKS.

	1.	2.	3.
Silica	57.59	55.30	53.04
Ferrous oxide	....	6.84	8.35
Ferric oxide	8.81	....	....
Alumina	14.87	3.72	4.32
Manganese oxide	....	0.22	Trace.
Lime	1.54	12.27	14.78
Magnesia	6.33	20.03	14.99
Soda	....	1.36	4.70*
Potash	....	0.48	1.34
Combined water	2.26	0.59	0.76
Total	91.40	100.81	102.28
Analyst	Smith.	Smith.	Smith.

*Soda probably too high.

No. 1. Partial analysis of "so-called" talcose slate, from Taylor's mill, Talladega county.

No. 2. Granular hornblendic rock, from Hurst's, Clay county.

No. 3. A similar rock, from near 'Squire Wheeless', Tallapoosa county.

Partial analysis of cupriferous pyrites from W. H. Smith's copper mine, Cleburne county.

Silica	6.68
Sulphide of copper	10.14
Sulphide of iron (pyrites)	80.39
	97.11

Metallic copper, 8.08 per cent.

APPENDIX A.

STATISTICS OF THE IRON INDUSTRY OF ALABAMA.

With a view to the publication in this report of these statistics, I addressed a circular to the Superintendents of the various Iron Works in the State, requesting the necessary data. As yet, I have the responses of three only, the letter of the Superintendent of the Shelby Iron Works having been lost.

At another time a complete table will be presented.

1. ALABAMA IRON COMPANY.

Post-office—Alabama Furnace, Talladega county, Ala., on Selma, Rome & Dalton R. R. S. S. Glidden, President; James L. Orr, Treasurer.

This Furnace was started October 1, 1873. Only one stack, 41 feet high; 8 feet 8 inches across the bosh; open top. Furnace yields from 20 to 22 tons of foundry iron per day. Hot blast; 3 blowing cylinders, 40 inches in diameter, and 6 feet stroke; steam cylinder 21 inches in diameter, and six feet stroke; fuel, charcoal; ore, brown hematite; ore beds about half a mile from furnace; limestone about the same distance.

2. TECUMSEH IRON COEPANY.

Post-office—Tecumseh, Cherokee county, Ala., on Selma, Rome & Dalton R. R. Willard Warner, President and Manager, Tecumseh, Ala.; W. F. Mason, Secretary and Treasurer, Rome, Ga.

The Furnace was put in blast February 16, 1874. One

furnace 12 by 60 feet, with top closed by bell and hopper; capacity, 20 tons per day, present yield, 15 tons; product, hot blast charcoal pig iron, at a cost of $18.00–$20.00; blowing cylinder, forty-eight inches by eighty-four inches; steam cylinder, 36 inches diameter, 48 inches stroke; engine run by four boilers, in two batteries; boilers 50 feet by 40 inches; engine upright, direct action, from the works of Messrs. Ainstie, Cochran & Co., Louisville, Ky. Ore, brown hematite, from beds in the immediate vicinity of the furnace; limestone, at two points, within a quarter of a mile from furnace; fuel, charcoal, made in bee-hive ovens, in which the yield is fifty bushels of coal to the cord of wood.

3. Stonewall Iron Company.

Post-office—Stonewall, Cherokee county, Alabama, on Selma, Rome & Dalton R. R., about three miles from the Georgia line. J. M. Selkirk, President; J. W. Bones, Secretary and Treasurer; William Wurts, Superintendent.

One stack 40 feet high, 11 feet across the bosh, open top; yield per day, 18 tons; product, pig iron, at cost per ton of $18.00; hot blast; engine, 100 horse power, horizontal; steam cylinder, 22 inches diameter, 6 feet stroke; blast cylinders, three in number, 36 inches diameter, 6 feet stroke; fuel, charcoal; ore, brown hematite; ore beds, near the furnace.

Of the other companies and works, I can give only the following notes:

Shelby Iron Company.

Mr. Craft, Superintendent; Col. J. S. Black, Assistant Superintendent. Near Columbiana, Selma, Rome & Dalton R. R.

5. Briarfield Iron Works.

Post-office—Briarfield, Bibb county, Ala.; Selma, Rome & Dalton R. R. T. S. Alviss, Superintendent.

6. Woodstock Iron Works.

Post-office—Anniston, Calhoun county, Alabama; Selma, Rome & Dalton R. R. A. L. Tyler, President; Sam'l Noble, Secretary and Treasurer.

7. Cornwall Iron Works.

Post-office—Cornwall, Cherokee county; Selma, Rome & Dalton R. R. President, ———.

8. Rock Run Furnace.

Post-office—Pleasant Gap, Ala.; Selma, Rome & Dalton R. R. Mr. Roy, Superintendent.

9. Eureka Iron Company.

Post-office—Oxmoor (Ironton), Jefferson county, Ala.; South & North Alabama R. R. D. S. Troy, President.

10. Cahaba Iron Works.

Post-office—Irondale, Jefferson county, Ala.; Alabama & Chattanooga R. R. Thomas & McKee, Lessees.

11. Iron Works.

Post-offie—Woodstock, Bibb county, Ala.; Alabama & Chattanooga R. R. Mr. Edwards, Superintendent.

12. Central Iron Works.

Rolling Mill.

Post-office—Helena, Shelby county, Ala.; South & North Ala. R. R. R. Fell, Superintendent.

APPENDIX B.

ALTITUDES FROM RAILROAD SURVEYS.

1. South & North Ala. R. R.

From F. L. Wadsworth, Engineer S. & N. Ala. R. R.

STATION.	ALT'TUDE
Montgomery	62 feet
Coosada	75 "
Elmore	99 "
Deatsville	200 "
Mountain Creek	442 "
Verbena	350 "
Cooper's	358 "
Clanton	496 "
Lomax	525 "
Jemison	606 "
Clear Creek	440 "
Calera	402 "
Whiting	455 "
Siluria	364 "
Pelham	327 "
Helena	300 "
Cahaba Mines	300 "
Brock's	464 "
Shade's Creek	512 "
Ironton	552 "
Birmingham	502 "
Boyle	424 "
Cunningham	340 "
Morris'	308 "
Warrior	449 "
Reid's	492 "
Blount Springs	334 "
Bangor	368 "
Gilmer	438 "
Phelan	592 "
Cullman	702 "
Milner	740 "
Wilhite	508 "
Falkesville	503 "
Hartselle	573 "
Flint	469 "
Decatur	477 "
Harris	464 "
Foot's	518 "
McDonald's	565 "
Athens	609 "
Hay's Mill	653 "
Elkmont	698 "
Tennessee Line	

2. SAVANNAH & MEMPHIS R. R.

From President Alexander.

STATIONS.	S.	T.	R. e.	ALTITUDE ABOVE PENS'COLA.
Opelika	7	19	27	819 feet.
Uchee Creek	....	....	....	774 "
Ridge	....	....	....	800 "
Loblocco	....	....	....	709 "
Gold Hill	13	20	25	770 "
Maddox	....	....	....	811 "
Big Sandy Creek	....	....	....	656 "
Ridge	....	....	....	736 "
Little Sandy Creek	....	....	....	660 "
Camp Hill	16	21	24	738 "
Creek	....	....	....	662 "
Dadeville	4	21	23	760 "
Buck Creek	....	....	....	670 "
Jackson's Gap	....	....	....	695 "
Manoy Creek	....	....	....	640 "
Ridge	....	....	....	683 "
Sturdevant	9	22	22	502 "
Tallapoosa Bridge	6	22	22	525 "
Ridge	....	....	....	760 "
Youngsville	27	23	21	747 "
Socopatoy Road	19	23	21	805 "
Kellyton	23	23	20	....
Socopatoy Creek	....	....	....	748 "
Baker's Creek	....	....	....	810 "
Goodwater	15	24	20	872 "
Wildcat Creek	....	....	....	810 "
Ridge	....	....	....	845 "
Hatchet Creek	6	24	20	790 "
Pine Grove Church	....	....	....	889 "
Valley	....	....	....	820 "
Rayfield's Gap	18	22	5	896 "
Valley	....	....	....	842 "
Thomas' Gap	12	22	4	870 "
Syllacauga	29	21	4	590 "
Oden's Mill	18	21	4	508 "
Ridge	....	....	....	549 "
Childersburg	20	20	3	452 "

July 3. 1903.

GEOLOGICAL SURVEY

OF

ALABAMA.

REPORT OF PROGRESS FOR 1875.

BY
EUGENE A. SMITH, PH. D.,
STATE GEOLOGIST.

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C

To His Excellency,

GEORGE S. HOUSTON,

Governor of Alabama:

SIR—The Report of Progress of the Geological Survey, for the year 1875, is herewith respectfully submitted.

I have the honor to be, sir,

Your obedient servant,

EUGENE A. SMITH,

State Geologist.

UNIVERSITY OF ALABAMA,

December 31, 1875.

LIST OF ERRATA.

On page 9, near the middle, for *Arcadian*, read *Acadian*.

On page 24, and wherever it occurs in the sequel, the word *chazy* should be printed *Chazy*, with a capital.

On page 26, near middle, for *Willis'*, read *Wills'*.

On page 27, 13th line from top, for *Keokuss*, read *Keokuk*.

On page 80, 8th line from top, for *omnipotent*, read *omnipresent*.

On page 91, 6th line from top, for *Ashley*, read *Ashby*.

On page 113, 5th line from top, for *limonite*, read *limestone*.

On page 129, near middle, for *fellspar*, read *feldspar*.

TABLE OF CONTENTS.

PREFACE.

In continuation of the plan adopted at the beginning of the survey, the work of the past season has been devoted chiefly to the examination of Silurian formations, and of that belt of Silurian rocks, particularly, which lies next adjacent to the Metamorphic rocks, which formed the subject of the last report.

In carrying out the work, the beds of limonite or brown iron ore, which occupy so considerable a part of the surface covered by the lower Silurian formations, have been examined wherever it was possible to do so; but to do complete justice to the ore banks of this region, a detailed survey of months duration would be necessary.

It was thought best to carry the survey a little more into details than was the case last year, and this will account for the comparatively small area gone over. It may be remarked, however, that the tracing out, and mapping down of the formations in those regions where the strata are highly inclined, require much more time and careful exploration, than where they are approximately horizontal; for where the broken edges of a series of tilted rocks form an outcrop, to map this outcrop, and consequently the occurrence of the formation accurately, it is necessary to trace out the entire line of outcrop, and since in comparatively small space, a number of different geological formations are brought up to the surface, it is easily seen how much field work the thorough examination of such an area necessitates.

Maps of Shelby, Talladega, and Calhoun counties, colored to represent the geological formations have been prepared. The printing of these maps is not provided for, and it has been impossible for me to present them with this report. I trust, however, that future reports will not be marred by this deficiency.

It is with pleasure that I acknowledge here the valuable aid which I have had, in the prosecution of the field work, from PROF. JAMES M. SAFFORD's published volume on the

Geology of Tennessee. The Tennessee sub-divisions have been generally followed in this report.

My thanks are due to the young men who took part in the field work; with their assistance I have been enabled to accomplish more than I could have done single handed. They are Prof. R. B. Fulton of Oxford, Miss., Prof. T. T. Mitchell of Greensboro, Mr. F. W. Wilkinson of Montevallo, Mr. Thos. W. Clark of the University of Alabama, Mr. John A. Ratchford and Mr. E. C. Rivers of Auburn College.

To Judge Thos. A. Walker of Jacksonville, to Col. J. Newton Smith of Bibb county, to Col. E. R. Smith and Mr. John Oden of Talladega county, I am indebted for many and great favors; and a general acknowledgment is also made to others for courtesies extended to members of the geological party.

To the kindness of Mr. J. Blodget Britton of Philadelphia, and to Prof. Wm. C. Stubbs of the A. & M. College, Auburn, the Survey owes a number of analyses made by them for the Survey free of charge.

Others are mentioned below in the Chemical Report, who have generously allowed analyses made for their private use to be published.

Courtesies extended by the officers of the South and North Alabama, and the Selma, Rome and Dalton Rail Roads, are also gratefully acknowledged.

I am under special obligations to Mr. HIRAM HAINES for the careful manner in which he has revised the proof of this report.

I take pleasure in laying before my agricultural readers a short article on the Cotton Worm of the Southern States, from the pen of Mr. Aug. R. Grote, Director of the Museum of Natural Sciences, in Buffalo, N. Y. Mr. Grote has long been a resident of Alabama, and has had greater facilities for studying the habits of the cotton worm than any other entomologist in the country.

A more elaborate paper on this subject, illustrated by a lithographic plate, has been promised by Mr. Grote, and it will probably be given in my next Report.

EUGENE A. SMITH.

University of Alabama, Dec. 31, 1875.

GENERAL OUTLINE OF THE GEOLOGICAL FORMATIONS.

The examinations during the past season have been extended over parts of Bibb, Shelby, Talladega and Calhoun counties, where I have identified and given some details concerning the geological formations named below. For the sake of greater clearness, the sequence of these formations, beginning with the lowest, their general characteristics and their equivalents in Tennessee, are given in a condensed form.

In the preparation of these tables the general arrangement of Prof. Dana has been followed; but I am indebted to Prof. Safford, (Geology of Tennessee,) for many of the details.

A. Silurian Age. A.[1] Lower Silurian.

I. Primordial or Cambrian Period.

1. Arcadian Epoch.

   Characters. Semi-metamorphic slates and conglomerates; mountain making.

   Examples. Slates and conglomerates in the Eastern parts of Calhoun and Talladega counties, and exposed along Talladega creek, &c.

   Equivalents in Tennessee. Ocoee conglomerate and slates.

2. Potsdam Epoch.

   Characters. Sandstones and sandy shales; mountain making.

   Examples.—Ladiga mountain, Cold Water mountain, Parnassus, Alpine mountain, part of Kahatchee hills, &c.

   Equivalents in Tennessee.—Chilhowee sandstone.

II. Canadian Period.

1. Calciferous Epoch.

Characters. Sandstones and shales, calcareous and of various colors; ridge making.

Examples. Sandstones of Montevallo, Helena, Jackson shoals, and ridge West of Jacksonville.

Equivalents in Tennessee. Knox sandstone.

2. Quebec Epoch.

Characters. Shales, chiefly with some limestone in lower part; shales, variegated—dolomite, with chert in the upper part. The shales are valley making; the dolomite makes ridges and valleys.

Examples. Variegated shales and dolomite of Montevallo, Helena, Talladega, etc.; the dolomite underlies the greater part of Talladega and Calhoun counties.

Equivalents in Tennessee. Knox shales and Knox dolomite.

8. Chazy Epoch.

Characters.—Blue argillaceous limestone, often quite pure, generally highly fossiliferous; valley making.

Examples. Limestone at Pratt's Ferry, Siluria, Calera, &c.

Equivalent in Tennessee. Maclurea limestone.

III. Trenton Period.

1. Trenton Epoch.

Characters. Fossiliferous limestones, black, blue, and light colored; valley making.

Examples. Buff colored fossiliferous limestones near Pratt's Ferry in Bibb county, part of the dark blue limestones of Shelby, &c.

Equivalents in Tennessee. Trenton.

2. Utica Epoch. Not recognized in Alabama.

3. Cincinnati Epoch.

Characters. Shales weathering buff colored; ferruginous sandy limestone.

Examples. Shales, &c., a few miles West of Jacksonville, Calhoun county.

Equivalents in Tennessee. Nashville group.

A.[2] Upper Silurian.

I. Niagara Period.

Of this period the rocks of the Clinton Epoch only have been made out, in the region under consideration; equivalent to the *Dyestone Group* of Tennessee, and of this group only the beds of fossiliferous iron ore in Bibb county, have been identified as belonging here.

Of strata of the remaining periods of the Upper Silurian, viz:

Salina, Lower Helderberg and Oriskany, I know of no occurrence in the region examined.

B. Devonian Age.

The only member of this age occurring in Alabama, so far as I know, is the stratum equivalent to the Black Shale of the Tennessee Report, and which is there placed as the representative of the Hamilton Period of the New York Reports.

C. Carboniferous Age.

I. Subcarboniferous Period.

1. Siliceous Group.

Characters. The characteristic rock, in this part of the State, is chert with impressions of shells, and especially of crinoidal stems; ridge making.

Examples. Cherty ridges between Montevallo and Calera, and at Calera, Shelby county; cherty ridges North from Calera, &c.

Equivalents in Tennessee. Silicious.

2. Mountain Limestone Group.

Characters. Limestones and shales.

Examples. The rocks of this group are best presented in North Alabama, but the shaly limestone, with fossils, six miles West of Columbiana, and also Southeast of Shelby Iron Works, probably belong here.

Equivalent in Tennessee. Mountain limestone.

II. Coal Measures, or Carboniferous Period. (2) (1)

Characters. Sandstones, shales and conglomerates, with *stone coal* interstratified.

Examples. The Coosa, Cahaba, and Warrior coal measures.

Equivalents in Tennessee and elsewhere. Coal measures.

D. Modified Drift.

GENERAL DESCRIPTION OF THE GEOLOGICAL FORMATIONS OCCURRING IN THE REGION EXAMINED.

In the preceding section, the names of the formations and their sequence have been given in tabulated form. It remains now to give a general description of these; after which, in a succeeding part of this report, the details of their occurrences in the different counties will be found under their respective headings.

SECTION I. LOWER SILURIAN.

I. PRIMORDIAL OR CAMBRIAN PERIOD.

The subdivisions of this period are, as above given—

1. ACADIAN EPOCH.
2. POTSDAM EPOCH.

As the strata of Acadian age have been examined particularly, only along Talladega creek, in order to save repetition, the reader is referred to the subdivision treating of these rocks under Talladega County. There is little doubt that the semi-metamorphic slates and conglomerate there described are the equivalents of Prof. Safford's Ocoee slates and conglomerates. Cabinet specimens from Talladega creek and from the typical Ocoee section in Tennessee, appear to be identical.

2. POTSDAM.

Next in ascending order, to the slates and conglomerates of the preceding group, comes a series of sandstones which form the most conspicuous mountains outside the Metamorphic and Acadian areas. The direct super-position of this sandstone upon the slates of the Acadian age, I have not seen in Ala-

bama, unless on the eastern edge of that belt, the prominent sandstone or quartzite ridge be, as seems quite probable, metamorphosed Potsdam sandstone. In the disturbed region of the Kahatchee hills, also, half metamorphosed slates are seen, some of which may belong to the Acadian epoch, whilst others are evidently altered Knox shales.

Lithological Characters, Distribution, &c—Fine grained conglomerates, heavy-bedded sandstones, and sandy shales, make up the great mass of the rocks of this formation. I have noticed also, occasionally, masses of a brownish porous chert, which, from its association with the sandstones, seems to be of the same age.

In general, the rocks of this formation are heavy bedded, almost massive, and the higher crests of the Potsdam mountains are usually covered with huge blocks of sandstone and fine grained conglomerate. In the lower parts of these ranges, sandy shales are the prevailing rocks. Some of the fine grained shales of semi-metamorphic aspect, found upon the Potsdam ridges of the Kahatchee hills, may be of this age.

The most characteristic markings of the rocks of this formation, are the sandy rods, caused by the filling in with sand of the burrows of a marine worm, *Scolithus linearis.* Upon the bedding planes of the sandstone, small rounded depressions, or dots, mark the cross sections of these Scolithus burrows. As yet I have found no other marks of organic origin in strata of this horizon.

From the nature of the rocks, it will be inferred that this is a mountain making formation, and the mountains of this age are, so far as our examinations have gone, the following: 1. Ladiga mountain, beginning north of Jacksonville, and running south and south-west to Oxford, where it ends. 2. Cold Water mountain, beginning at Oxford, near the termination of Ladiga mountain, and extending westward nearly to Choccolocco creek. 3. The Talladega range, beginning just south of Choccolocco creek, and extending south-westward to Alpine, where it terminates in three very prominent peaks, from which a short spur turns off towards the south. 4. The Kahatchee hills, beginning near Childersburg, and

forming, (1) a ridge following nearly the course of the Coosa river, and ending with the mountains about the Sulphur Springs; and, (2) a series of east and west ranges extending from the edge of the Acadian hills, in the lower part of T. 20, R. 4, E., and the middle of T. 21, R. 4, E., westward for eight or nine miles, and then widening out into the Kahatchee hills proper, south of Childersburg.

These mountains all rise abruptly from the surrounding plains, to heights varying from 375 to 1,225 feet above the plains. Characteristic, also, is the abrupt way in which a mountain range ends, the sandstones forming it disappearing entirely, thus forming isolated chains.

The strata in the mountain ranges enumerated, all dip at tolerably high angles SE. or S., with the exception of one small part of the east and west range of the Kahatchee hills, Pope mountain, where the dip is north.

Upon the side opposite the direction of the dip, these ranges are bounded by *faults*, the Potsdam having in most cases been brought up to the level of the Knox dolomite, though in several instances, it seems, to the level of higher groups. In the Kahatchee hills, and near the Sulphur Springs, there is reason to believe that the displacement has brought the Potsdam sandstone to the level of the *Black Shale*. The broken edges of the Potsdam rocks seem to be thrust up through the overlying formations.

All these mountains are, as Prof. Safford has noticed in Tennessee, great *outliers*, being found at distances varying from three or four, to ten and twelve miles, from the mountains of Acadian slates, with a valley or lower tract of Knox dolomite intervening. In Calhoun county, several subordinate ridges of very moderate height have been noticed between the main outlying mountain of Potsdam sandstone and the Acadian hills.

The nature of the rocks of this group, conglomerates, sandstones, and sandy shales; the fossil markings, principally the burrows of marine worms, &c., all point to a sea-shore origin.

Useful Materials.—Many of the rocks described above would make good building stone, especially the more sandy and less

compact portions: some of the shales might be used as flagstones. Pyrites seems to be widely disseminated in these rocks, giving rise by its decomposition to numerous chalybeate springs.

Agricultural Features.—As a matter of course, good farming lands could hardly be looked for upon the barren sandstone mountains of this age.

Many additional details may be found under the several counties, especially Talladega.

II. CANADIAN PERIOD.

In the condensed view of the geological formations, given above, I have adopted Prof. Dana's classification of this period into the Calciferous, Quebec, and Chazy epochs; by which the equivalent of the Alabama rocks are sufficiently well shown.

In the sequel I shall follow the subdivisions of Prof. Safford, and throw together the Calciferous and Quebec groups, under the general name of *Knox Group*, so called from Knoxville, Tenn., where the formation is best seen.

The Knox group, according to Prof. Safford, is of threefold nature; below, thick and thin bedded sandstones and hard shales, passing upward into shales of various colors, and these into limestone or dolomite.

The group is therefore divided into

1. Knox Sandstone.
2. Knox Shale.
3. Knox Dolomite.

These three subdivisions form in Alabama, as well as in Tennessee, *lithologically* a natural group, for the sandstones and shales are separated by no well marked line of distinction: the colors of the rocks even, though universally bright and pleasing to the eye, are much the same in both divisions. So, also, the upper part of the shales holds interpolated beds of limestone, by which its transition into the overlying dolomite is made by easy gradations, and the line between them correspondingly difficult to draw.

Another circumstance which has its weight may be here

mentioned: from personal observation, I know that the sandstones, shales, and dolomite, of the Tennessee Knox group, have their exact equivalents in Alabama, and considering the geographical relations of the two States, I have thought it best to adopt the same names.

Occasionally, below, the term Calciferous Sandstone is used, as equivalent to Knox Sandstone, and Quebec Shales and Quebec Dolomite, as equivalent to Knox Shales and Knox Dolomite; but with the explanation given above, there will scarcely be any danger of misunderstanding.

1. Knox Sandstone.

The rocks of this group succeed next, in ascending order, the Potsdam Sandstone, and they are often, no doubt, found resting directly upon that rock. I have not, however, often seen them in this position; but much oftener just on the south-east side of a fault by which they have been raised to the level of a much higher formation. This sandstone is more generally associated with the shales of the next higher group, and these with the dolomite, so that three groups are usually closely associated *geographically*, as well as *lithologically*.

Kinds of Rock, Distribution, &c.—A calcareous sandstone; sometimes thick, sometimes thin-bedded, is the characteristic Knox Sandstone.

It is associated with hard calcareous shales, much like the shales of the next higher division. The bedding planes of the sandstone commonly show ripple marks, and irregular raised markings which are commonly supposed to be fucoidal impressions. The bedding planes are also frequently smooth, and shining as if polished. Green grains of a glauconitic mineral are usually to be seen upon a fresh fracture of the sandstone; upon weathered surfaces, the brown color of hydrated ferric oxide is often the result of the decomposition of this mineral. The colors of the Knox Sandstone are pleasing to the eye, and are gray, greenish brown, buff, chestnut colored, &c. Beds of dolomite, impure and cherty, are found in the upper part of this formation; two such calcareous beds

were noticed in the exposure of Knox Sandstone at the Jackson shoals, and also at Helena.

From the nature of the rock, prevalently a hard sandstone, alternating with shales, this formation is a ridge making one, and the ridges are usually rather sharp crested. Where the formation is cut by a water-course, the wearing out of the intervening softer shales, leaves the sandstone layers in a series of ledges exposed above the water level; good instances of this may be seen at the Jackson shoals, at Helena, and on Six Mile creek in Bibb county. Such natural dams afford fine mill sites, as the water power can be utilized with very little expense.

The Knox sandstone is found next to the Coal Measures of the Cahaba fields, from which it is separated by a fault, at Montevallo, at Helena, and between those two places. Probably, also, it lies south-east of those coal fields further north, though I have not yet had the opportunity of observing personally any further north than Helena.

At the latter place the junction of the two formations may be seen a short distance above the rail road bridge across Buck creek.

In Talladega county, west of the Potsdam sandstone range, a ridge of Knox Sandstone is brought up by a fault against Knox Dolomite; and three miles west of Jacksonville in Calhoun county, a similar ridge has on its western side strata of the Cincinnati group. In Bibb county the sandstone is brought up to the level of the Chazy, or perhaps Lower Trenton. It will thus be seen that where Knox sandstone is best exposed it is on the south-east side of the line of a fault.

It would naturally be looked for, overlying directly the Potsdam sandstone of the mountains enumerated in a previous section; but it is not always easy to distinguish it: since, however, these ridges of Potsdam sandstone have a well defined belt of Knox Shales on their eastern and south-eastern flanks, the Knox Sandstone, probably in most cases, intervenes between the two.

Useful Materials.—The sandstones and shales of this division are commonly rich in iron, and under favorable circum-

stances beds of limonite may be formed; but the ore banks are almost entirely confined to the upper division—the Dolomite.

The sandstones are occasionally used for building, in rough work, such as dams, pillars, &c., and the calcareous beds furnish sometimes the material for lime burning; for which purpose, however, they are ill adapted.

2. KNOX SHALES.

The characteristic rocks of this subdivision of the Knox Group are calcareous shales of bright and agreeable colors, usually gray, buff, greenish, brown, chestnut-colored and red. The shales are tolerably soft, and in some portions in weathering, break up into small angular pieces resembling shoe pegs. Strata of dark blue limestone, sometimes banded with argillaceous layers, are found, especially in the upper part of this division. The weathering of such limestones brings into relief the bands or stripes of argillaceous matter, and the limestone appears very distinctly banded. Where these impurities are not so regularly disposed in layers, but in patches, the prominence given to them by the weathering away of the limestone gives them a striking resemblance to half exposed fossils.

In some places layers of dark colored oolitic limestone have been observed, one of the best localities of this peculiar rock being at the foot of the mountain at Alpine Station in Talladega county.

In the upper part of the division blue limestone layers become more frequent, and the transition into the overlying Dolomite is so gradual that a line between them lithologically is hard to draw.

From the nature of the shales, they are constantly found in valleys, an exception being in some of the very impure layers of argillaceous limestones, which are sometimes found making small ridges. An instance of this kind may be seen near Montevallo, where the clayey limestone forms bluffs overhanging the little stream known as Davis' creek.

The Knox Shales are found with Knox Sandstone, in Bibb county, in one or two belts, as described below in the proper

place; also with the sandstones on the south-east of the fault separating the sandstones from the Coal Measures at Montevallo, Helena, &c.; also overlying the sandstone where the latter makes the ridges mentioned above in Talladega and Calhoun counties; and lastly upon the south-eastern flanks of the ranges of Potsdam Sandstone already enumerated. Between the Ladiga mountain and the hills of Acadian slate in Calhoun county, there are numerous small ridges of Potsdam sandstone, on the flanks of which the Knox Shales seem never to be wanting.

I have not yet observed any fossiliferous strata in this division.

The soils produced by the Knox Shales are usually productive, strengthened by the calcareous matter contained, but rather liable to suffer from drouth.

With the exception of occasional small beds of limonite, I know of no useful mineral obtained from this division. Some of the limestone layers, especially in the upper part, are pure enough for lime burning.

3. Knox Dolomite.

This succeeds the shales in ascending order, and as has already been stated the line between the two is hard to draw, since the lower parts of the Dolomite contain beds of blue limestone similar to those in the upper part of the Shale. One of the best localities for studying the rocks of this entire group, from the sandstone up, is the vicinity of Montevallo, where they are well exposed. In the western part of the town the beds of blue limestone, which are found near the base of the Dolomite, are well seen.

Speaking of this division in Tennessee, Prof. Safford says, "it is the most massive formation of calcareous strata in the State." The same remark may be made of its occurrence in Alabama. A large part of Bibb and Shelby, and by far the greater part of the areas of Talladega and Calhoun, are underlaid by the rocks of this formation.

Lithological Character, &c.—The blue limestone layers in the lower part of the Dolomite have been mentioned: these are interstratified with shales; following these, come thick

beds of gray dolomite, crystalline, sometimes sandy, and usually much contaminated with chert. The presence of chert throughout the dolomite gives rise to the numerous rounded ridges which are so characteristic of this division. The dolomite is often so charged with sandy matter as to resemble to some extent a sandstone, and as it resists denudation, it is frequently found making small hills and ridges: the exposed surfaces of such dolomites are generally crossed with furrows, giving them a hacked appearance.

In some of its exposures, the upper part of the Dolomite has layers of impure blue limestone which are said to be good lithographic stones; but a more characteristic feature of the upper part is the great amount of chert which it contains. In some parts of Talladega and Calhoun counties, where this chert abounds, the dolomite is inconspicuous, its presence being indicated chiefly by the "lime sinks" or depressions caused by subterranean erosion and subsequent caving in of overlying strata, the whole country being made up of a series of rounded chert ridges, covered with a growth of long-leaf pine.

Prof. Safford gives as a characteristic of the chert from this horizon, the rhombohedral cavities with which it is frequently pitted: the cavities being the moulds from which crystals of dolomite have been weathered or dissolved.

An equally good characteristic of it is given by Prof. Frank H. Bradley, in its concretionary structure. Such are also its characteristics to some extent in Alabama; but much of the chert which I have examined shows neither characteristic.

It is found sometimes in large rough cavernous masses, imbedded in red clay, giving evidence of its origin from cherty limestone or dolomite. Again, the gray angular flint gravel which covers most of the ridges of the division are of chert; frequently, also, it appears less like chert and more like a sandstone.

The distribution of the rocks of this division in the different counties may best be seen by referring to those headings.

Topography, &c.—From the presence of so much chert throughout the Dolomite, this is a ridge-making formation, and especially in those parts where the chert abounds. Be-

tween the cherty ridges are, on the other hand, often smooth and fertile valleys. The road from Talladega to Syllacauga, over Knox Dolomite, is one of the best in the State, though numerous cherty ridges are crossed.

It is worth noticing that where there is great abundance of limonite, and the clay of the soil is impregnated with iron, the soil is usually quite productive, and the country gently rolling rather than broken. Where limonite is found in the broken chert hills, it is very often largely contaminated with the chert.

As to the thickness of this formation in Alabama, I have no reliable data for a correct estimate ; it must be, however, very great.

Useful Materials.—The dolomite holds layers of black limestone with reticulating veins of white calcite, which are worked into handsome slabs. The black marble in Talladega county is of this nature. Where exposed to metamorphic action, the dolomite sometimes affords good statuary marble. I have ventured to assign the crystalline marbles of Talladega county to this horizon; fuller details concerning it can be found in Tuomey's reports, and below in this report.

Calcite, the crystallized carbonate of lime, is quite common in veins and crystalline masses. The best occurrence of calcite in very large masses is near Syllacauga, where it has been used for lime burning. Specimens from here showing cleavage faces several inches in diameter are easily had.

Dolomite, carbonate of lime and magnesia, is common in crystals lining cavities in the rocks of this formation, and the same may be said of *Quartz*, which is of frequent occurrence.

Barite or *Heavy Spar*, is found in veins at several places in Bibb county, e. g. near Maguire's Shoals on Little Cahaba, near Six Mile creek, &c. In Shelby, east of the railroad (S. & N.) opposite Whiting, or Longview; also in Talladega and Calhoun at several points.

Black Oxide of Manganese, commonly accompanies the ores of iron, as near Woodstock furnace, where tolerably pure specimens are to be found. Much of the limonite in some localities has a considerable percentage of manganese. Near

Kelly's creek in Shelby county, very pure black manganese was found in a mass of several inches in thickness, in digging a well.

Galenite, (Sulphide of Lead.)—A limestone or dolomite of Calhoun county, west of Jacksonville, impregnated with galenite has for many years been known, but as yet no vein of the ore has been discovered, and the amount of lead in the limestone is not sufficiently large to pay for working.

Limonite or Brown Hematite, is the characteristic mineral of the Knox Dolomite. The other two divisions of the Knox group, show occasionally such accumulations of limonite as to justify the name of ore banks; but it is to this upper division that the productive ore banks are confined, and it seems to be the fact that the largest accumulations of limonite occur in the belt of the dolomite which lies nearest the mountains of semi-metamorphic slates of the Acadian Epoch, though ore banks sufficiently large to justify the erection of blast furnaces, are found at a distance from the mountains.

Of the origin of the limonite, I think there can be very little doubt that it has been set free by the decomposition and wearing away of ferruginous limestones and dolomites, and deposited in beds at or near the places once occupied by the limestones. There seems to be little evidence to show that the ore has been far removed from its original position, though some of it has evidently been so moved. The beds of ore, following as they do the outcroppings of certain strata, have something more than an accidental connection with such strata. This opinion has long been held by some geologists, though others hold to opposite views.

I have occasionally seen limonite which has undoubtedly been derived from the oxydation of pyrite; and one instance may be cited in an occurrence near Oxford, Calhoun county, where masses of limonite, on being broken open, show a nucleus of unchanged pyrite; and again, the pseudomorphs of limonite after pyrite, are not very rare.

As to the quality of the ore, analyses show that a great part of it contains too much phosphorus for use in making Bessemer steel, whilst for ordinary foundry iron, for commer-

cial bar and rails, it is most admirably adapted. A few very extensive ore banks, however, show that small percentage of phosphorus in the ores, which fits them for making Bessemer metal.

It must be remembered that ores have as yet been analyzed from a few only of the many localities where they occur, and that analyses made hereafter, may show many other banks, where the ore is comparatively free from phosphorus.

In this connection, I may remark that the manufacture of steel is likely soon to be placed upon a new footing, by the discovery of a process by which steel may be made from the common phosphoric irons, instead of the rare non-phosphoric irons which have hitherto been alone considered the only material from which steel could be made.

A patent for this process has lately been issued.

Before leaving this division, mention may be made of the many bold limestone springs which are found everywhere in the region of Knox Dolomite.

A few of the most notable of these springs will be noticed below in the details of the counties.

The so-called "lime sinks," are likewise frequent in the same area. In a few instances which have come under observation, considerable streams have in some parts of their courses underground channels; as Six Mile creek in Bibb county above Centreville.

Chazy Epoch.

The upper part of Knox Dolomite passes into the chazy limestone, which is, in general, an argillaceous limestone, of blue color. It sometimes, in weathering, breaks up into irregular knots or lumps, sometimes with more or less regular blocks. This last character, however, is usually noticed where the limestone is thin bedded and flaggy. Other portions of the chazy limestone are quite pure, and compact, and large, smoothly rounded masses of it are not uncommon, with the marking of its characteristic fossil, *madurea magna*, upon weathered surfaces. Where the rock is not very thick bedded and somewhat homogenous, the upturned edges of the beds

may be seen outcropping in parallel lines over considerable areas. The regions about Siluria station and northward, afford good examples. Red cedar is the usual growth upon such tracts.

The chazy limestone has been observed in Bibb and Shelby counties, next adjacent to the Knox Dolomite; in Shelby county it is seen in five or six alternations with sub-carboniferous chert, between Montevallo and Calera. The greater part of the limestone at the last named place, as well as northward towards Longview, Siluria, &c., is chazy; but it is probable that the upper portions of the limestone beds found at the places mentioned, may be of Lower Trenton age, (*i. e.* Black river, or Bird's Eye Limestone); but as yet the fossils have not been collected, which can decide this point.

Upon many of the rounded weathered masses of limestone of this period, little ridges are common, radiating from a raised central point, "as if the fingers had been drawn over it when soft."

Outcrops of chazy limestone in Talladega, I have not yet seen; but in Calhoun, one belt has been noticed with the Cincinnati beds west of Jacksonville.

Useful Materials, &c.—Most of the limestone for lime burning in Bibb and Shelby counties, is obtained from this horizon, or from the beds of the Lower Trenton just above it, it being as yet not possible to determine whether beds of the latter group do not make part of the limestone strata in those localities where the lime burning is carried on.

The excellence of the Shelby lime has long been known, and the purity of the rock from which it is made, is sufficiently evident from analyses given below.

Trenton Epoch.

Since beds of this age have been definitely recognized as yet, only in one locality in Bibb county, it is not deemed necessary to repeat here what is said below, and the reader is therefore referred to the section treating of the occurrence of Trenton limestone in Bibb county.

Cincinnati Epoch.

The buff colored shales with interpolated beds of marble, and Iron-limestone, a few miles west of Jacksonville, are the only Cincinnati beds observed in the counties examined during the summer, and the remarks upon this occurrence will be found under Calhoun county, to which the reader is referred.

Section II.

UPPER SILURIAN, CARBONIFEROUS, MODIFIED DRIFT.

UPPER SILURIAN—NIAGARA PERIOD.

Beds of this period have been observed in Bibb county, a few miles north of Centreville, from which point they extend, with occasional interruptions, north-east into Georgia and beyond. The fossiliferous or lenticular iron ore bed of the *Clinton Epoch*, of the Niagara Period, which is the particular stratum under consideration, is that which furnishes the ore for several furnaces north-east of Bibb county. A fuller discussion of this and associated beds must be deferred to a future report, which is to treat more especially of the geology of the Silurian Valley, which, under the names of Roup's Valley, Murphree's Valley, and Willis' Valley, traverses the State from Bibb county north-eastward into Georgia.

Carboniferous Age.

This age we have subdivided, as above shown, into the
Sub-Carboniferous Period and the
Carboniferous Period, or Coal Measures.

The sub-carboniferous rocks in the region examined, belong probably to two groups which are named from the Tennessee Report, the *1. Siliceous Group,* and
2. Mountain Limestone.

In the States further north, this Lower or Sub-Carboniferous Period is susceptible of several well defined divisions. In Tennessee, these divisions are not so well marked, and it is probable that in our own State, the same will be found to hold

good. In Shelby county two very distinct occurrences of sub-carboniferous rocks have been observed; the one, forming several well defined ridges alternating with chazy limestone, between Montevallo and Calera; at the last named place, and also in ridges running north from Calera, on the eastern side of the S. & N. R. R.

The principal rock of these ridges is a chert, filled with the impressions of shells, crinoidal stems, &c., and cellular or porous in consequence of the removal of the calcareous matter of the shells.

Some of the specimens have been submitted to Prof. A. H. Worthen, of Illinois, and have been pronounced by him as of the Keokuss age of the Lower Carboniferous of the Illinois Reports, which is partly, at least, equivalent to Prof. Safford's Siliceous Group.

The other occurrence of sub-carboniferous rocks in Shelby, is between Siluria and Columbiana; but still better defined some miles south-east of the Shelby Iron Works, where several beds of an argillaceous blue limestone, weathering into shale and highly fossiliferous, are found. From fossils of this locality submitted to him, Prof. Worthen considers them as probably of the age of the Chester Limestone of Illinois Reports, which is, I presume, the equivalent in part of Safford's Mountain Limestone. The mountain limestone, however, has its best development in North Alabama, still it is interesting to know that beds of this and the preceding age of the sub-carboniferous, are found so far south in Shelby county, where their existence has heretofore, I believe, not been suspected.

Useful Materials.—Upon the flanks of most of the ridges of chert of this period, are found banks of limonite, sometimes of considerable extent. As a general thing, however, the limonite encloses chert, often pulverulent and resembling chalk, which interferes seriously with its fitness as an ore of iron. No analyses of this ore have been made as yet for the survey, and I do not know whether it contains other deleterious admixtures or not.

Some of the cellular masses of chert are quite hard and flinty, and would doubtless make excellent buhr stones.

Coal Measures.

As a preparatory step to the full and complete survey of our coal fields, it seemed to me very desirable that a short account of the development of the fields up to the present time; the methods of mining; modes of shipment; of the different mines worked; their product, capacity, &c., should go before. Accordingly, I requested Mr. T. H. Aldrich of the Montevallo coal mines, to collect for me notes upon the coal fields, with a view to the publication in this report of such a preliminary sketch as that outlined above.

To this request Mr. Aldrich has kindly responded, and he has thrown together his notes in the following form. I doubt not that the information conveyed in these notes, will be very acceptable to all of our readers:

I. HISTORICAL ACCOUNT OF COAL MINING OPERATIONS IN ALABAMA SINCE 1853.

Cahaba Fields.

The first systematic attempt at the mining and shipping of coal, was made in the Cahaba coal field near its southwestern extremity, above Pratt's Ferry and on the right bank of the Cahaba river. The company was formed by a number of the citizens of Montgomery in 1853; the coal was mined by drifts and loaded upon barges, with the expectation that the navigation of the river would be practicable. A few barges were loaded and started down the Cahaba; all of them, with the exception of one, were wrecked upon the rocks and shoals of the lower falls at Centreville. The barge that escaped was floated down the river to Cahaba, and thence up the Alabama river to Montgomery.

After this attempt the enterprise was abandoned, the difficulties in the way of navigation of the river being at the time deemed insurmountable.

The citizens of Bibb and Shelby counties, for many years previous to this attempt, had been in the habit of obtaining

coal for blacksmithing purposes from the Cahaba fields. In 1852, Mr. D. H. Carter, then residing near Montevallo, mined several car loads of coal from what is now known as the Lemley seam, hauled it to the terminus of the Alabama and Tennessee Rivers Rail Road, (now S., R. & D. R. R.) and shipped it to Montgomery, where it was sold for $6.00 per ton. The coal was used principally for blacksmithing purposes.

These attempts at mining of coal, and the prospect of the early completion of the Alabama & Tennessee Rivers Rail Road to Montevallo, directed attention to the eastern part of the fields. In 1855, a charter was obtained by a number of the citizens of the State, and a company organized under the title of "*The Alabama Coal Mining Company.*" In this connection, I take pleasure in calling attention to a report upon the coal lands of this company, made by Prof. Tuomey in October, 1855. (See Appendix "A.") It will be seen that this report was intended to be incorporated in Prof. Tuomey's Second Biennial Report to the Legislature, but on account of his death, and the scattering of his notes and papers, it was never published, and no apology is necessary for its reproduction here. It is interesting to notice the accuracy of Prof. Tuomey's observations, notwithstanding the difficulties in the way of geological explorations at that early day, as well as his philosophical speculations upon the probable future of the coal trade in Alabama. The very same hopes and expectations are indulged in to-day, perhaps with a better prospect of their early realization.

In conformity with Prof. Tuomey's recommendations, a slope was sunk and a fine engine erected upon what is now known as the "Shaft Vein," which is one of the highly inclined series. This opening was in the south-east quarter of the north-east quarter of S. 1, T. 24, R. 11, E., of the Lower Survey. The depth of the slope is 175 feet. At 150 feet depth headings were turned off, east and west along the vein, and mining operations regularly begun. The branch railroad, still used for the purpose of transporting coal, was energetically pushed through to completion by the Company, and shipments of coal were made to Selma, and thence to other

parts of the State. Operations by this Company were continued till the latter part of 1859, or the first of 1860; the largest amount shipped by them in this time being 33 tons per day during one month.

Owing to several fatal accidents, the difficulties of keeping a sufficient force employed at the mines were very great, and the creation of a market for their products being a slow process, and expensive, the project was abandoned.

As far back as 1836 coal was obtained from what is now known as the Fancher Pit. At this opening, as well as at the Wood's Pit, both openings being upon the Montevallo vein, the Alabama Company had obtained small amounts of coal.

The war beginning, renewed attention was directed to these fields, and in 1863 the *Montevallo Coal Mining Company* was organized, and a purchase made of the lands, plant, and rail road of the Company. Energetic work was now begun upon the Montevallo vein; new pits were opened, and coal extracted at the Fancher Pit, the Wood's Pit, and at many other openings along the outcrop of this vein. The largest shipment made was eighty tons per day, although the capacity of the mines was far greater than this.

At the close of the war a lease was made of these works by Mr. E. G. Walker, now of Montevallo, who carried them on till their purchase by the *Central Mining and Manufacturing Company,* the remaining lands of the Montevallo Coal Mining Company passing into the hands of other parties.

The Central Mining and Manufacturing Company continued operations above the water level, principally at what is now called the Irish Pit, until the latter part of 1867, when a slope was sunk at this point six hundred feet deep, a double cylinder engine of 40 horse power was placed in position, a narrow guage road built to the main branch, where a fine shoot was erected. The slope was sunk in the coal, which dips one foot in nine, north 2 deg. east; the system of mining being that known as *long wall advancing.* The engine was placed ninety feet vertically below the surface of the ground, the smoke being carried up by a shaft to the surface, and the water raised by a steam pump.

This mine was next worked by the purchasers under a mortgage, Messrs. Josiah Morris and others. The property then was redeemed, and leased in 1870 or 1871, to the *Cahaba Coal Company*, who worked it for about twelve months. It then passed into the hands of the late Albert Williams and others. These parties began operations under the firm name of Messrs. Holt, Varner & Co., in 1872, Mr. S. D. Holt being the active manager. This firm continued the work here until the final abandonment of the mine, in the spring of 1874, mining during the last twelve months between 12,000 and 13,000 tons of coal.

The late William P. Brown of Montevallo was the owner of a considerable tract of land adjoining the lands of the Old Alabama Mining Company, embracing part of the vertical veins as well as the Montevallo vein. Pits were sunk by him at several points along the outcrop of the Montevallo vein, and worked in a small way from 1856 to 1863, when a sale was made of this property to a Company organized as the *Mobile and Selma Coal Mining Company*.

This Company worked the Montevallo vein only, at a point near the Irish Pit, their headings even connecting with those of the old pit; and also at a point in S. 19, T. 22, R. 3, W., near the center of the section, now known as the Brown opening. This opening is in a ravine, at about the lowest point on the eastern edge of the field, and within 500 feet of the Silurian rocks. The vein at this point dips N. 4 deg. E., and at an inclination of about 1 in 10.

The Company built a branch road from the main branch to this opening, erected shoots, &c.

Operations were carried on here by the Company till the close of the war, only a small amount of coal being mined. In 1866 the mine was leased to Mr. William P. Brown, the former owner of the property, who worked it about two years; it was then leased to the Cahaba Coal Company, who also worked it about three years, driving the main gangway a distance of 1,000 feet. The mine was then leased by Mr. D. A. Smith, who sold out in February, 1873, to T. H. Aldrich. Mr. Smith mined about 4,500 tons of coal during the time of his lease.

The working was continued by Mr. T. H. Aldrich, upon the water level, and in the summer of 1875 the drift had been carried to the boundary of the property, a distance of 2,800 feet from the mouth. The amount of coal mined in 1873 was about 7,000 tons, and in 1874 about 12,000 tons. In May, 1875, a slope was started at a distance of 1,300 feet from the mouth of the mine, and continued down on the dip towards the basin, a depth of 300 feet, and a new "lift" was started. The output of the mine for 1875 is about 16,000 tons.

At the head of the slope a chamber was cut out of the "solid," a 40 horse power engine and boilers put in, connecting with the surface by a shaft through the overlying conglomerate 103 feet in thickness.

A fact worthy of notice is the manner of filling the boiler with water. A tank on the surface fed by an unfailing spring of pure water, is connected by a siphon made of 1½ inch gas pipe passing through the shaft, directly with the boiler below. The weight of the column of water is sufficient to fill the boiler against the usual steam pressure, and the warm air ascending in the shaft heats the water so that a heater is unnecessary.

To complete the historical account of the operations in this region, it may be stated that a small amount of coal has been mined by T. S. Alviss & Co., from the Lemley vein, and used in the puddling furnace at Brierfield, and coke made from the same coal mixed with charcoal was used, with poor results, in the blast furnace.

The necessities of the Confederate Government in 1863 gave an impetus to the exploration of the Cahaba coal fields, as a large foundry for making cannon and heavy ordnance was located in Selma, and a good quality of coke was needed for melting the pig iron. Many openings were made along the veins in the immediate vicinity of the Cahaba river. The principal openings, beginning at the lowest, or most southerly, are here given. Thompson's Lower Mine, on Pine Island Branch, in S. 10, T. 24, R. 10, E., on the Gholson seam: coke

was made here in the open air and hauled over the hills to the rail road for shipment to Selma. At the close of the war a large amount of coal was left at the mouth of the pit, and the inhabitants in the vicinity have supplied themselves with fuel from this pile up to the present day. The excellent quality of this coal is shown by the fact that it burned freely in grates after years of exposure to the atmosphere.

The next opening is in the north-west part of S. 1, T. 24, R. 10, E., upon the Thompson seam, known as the Thompson Upper Mine.

Next above is the Herndon Mine, about 1½ miles north-east of the Thompson Mine, and upon the same seam. Openings at this point were also made upon a seam underlying the Thompson seam.

A large quantity of coke was made in the adjoining parts of sections 12 and 13, T. 22, R. 5, W., at the Coke Seam opening and the Gholson opening, upon the coal seams bearing those names, near Daly creek.

Mr. George H. Gardner opened what is called the Big Seam, upon fractional S. 28, on Little Ugly creek, on the west side of the river; but the coal proved too soft to be of much value.

Further north, several (nine or ten) openings were made upon the Gholson Seam and one underlying it.

The coal from these places was found to make an excellent quality of coke. It was used with great success in casting cannon at Selma. Most of these openings are in S. 29, T. 21, R. 4, W.

Next towards the north, in the vicinity of Helena, we arrive at another point where active operations were conducted during the war. The South & North Alabama Rail Road was built with a temporary track from Calera to this place, and a branch road one and three quarters of a mile in length, was run out into the central part of the field to afford the facilities for handling and transporting the coal iron.

A very large force was employed in building the tram roads, shoots, &c., and an enormous number of openings was made simultaneously upon four or five different seams. This

was done principally in the years 1862 and 1863, the *Rec Mountain Iron and Coal Company* being the chief operators Two slopes were sunk upon the Helena seam; a long tran road was built, reaching down nearly to Beaver Dam creek the greater part of the coal being taken from the Helena and Beaver Dam seams.

During these two years and up to the close of the war, it is estimated that over 30,000 tons of coal were mined in thi vicinity. A large amount remained at the mines, and wa shipped after active mining operations were discontinued, and five thousand tons in one pile were burned at one time at th company's shoots.

A slope was also sunk, about one hundred feet deep, upon the Little Pittsburgh seam, by Messrs. Raney and Holmes.

Messrs. Moyle and others, also sunk a slope upon what i known as the Moyle seam. A fine engine and proper ma-chinery were erected, and active operations were kept up unti 1865, when the plant was destroyed by Wilson's raiders, and nothing has since been done at this mine, which is known a the Southern Mine.

Messrs. Woodson & Gould opened in 1863 the Cahaba seam by a slope near the river in section 9, upon the north dip of this seam. A more detailed description of this open-ing will be given below under the heading of the Cahaba Coal Company.

Cahaba Coal Company.

In 1866, Messrs. Woodson and Gould sold out their mine to a company organized under the name of the Cahaba Coal Company, composed chiefly of northern and western men At the time of their purchase the slope had been sunk three hundred feet, a small engine had been erected, and the water was hoisted by means of a water car. This company contin-ued the slope and mined extensively until the following year, 1867, when the mine was flooded by the great freshet of that year.

Notwithstanding this disaster, the company pumped out the water and began anew. In 1868 the temporary track of

the S. & N. R. R. being in bad condition, this company leased it and put it in a complete state of repair. It will be remembered that they were at the same time the lessees of the Brown Mine, belonging to the Mobile & Selma Coal Mining Company, and that they also controlled, through Col. R. M. Moore, their Superintendent, the Irish Pit; thus having sole control of the entire trade. In the latter part of 1869 or in 1870, the company discontinued the business.

It is estimated that up to the year 1870, the Cahaba Mine had produced over 40,000 tons of coal.

In the spring of 1872, the mine was again flooded, and so remained until the summer of 1874; it was then leased by Mr. S. D. Holt, who, in the short space of three months, pumped out the water and began work. He has sunk the slope one hundred and sixty feet further towards the centre of the basin, and started two new lifts. The present production of the mine is about sixty tons per day.

The mouth of the slope being lower than the air course openings, the water first found entrance to the mine there, carrying down in the rush the blacksmith shop and an immense amount of debris from the immediate vicinity. The rush of water was so rapid that air in the lower courses was strongly compressed, and burst out from the other openings with a loud explosion. It was supposed by many, incorrectly as events have shown, that this explosion had ruined the mine by letting in the waters of the river, as the headings on the west side of the slope extend under the bed of the river.

Glasgow Coal Company.

In 1866 or 1867, William Gould and others, having sold out their mine to the Cahaba Coal Company, opened a new one upon what is now known as the Gould seam, at a point about 1¾ miles north-west of their former one. This seam was found to yield an excellent coking coal. The mine was first worked by drifts above the water level; but afterwards a slope was sunk, and the hoisting was done by means of a whim. The seam is quite irregular, averaging about four feet in thickness; the dip being about 20 degrees towards the

south-east. The coal is soft and easily mined. After some years time, work was discontinued here, partly on account of the small demand for coal and coke, partly on account of the difficulties in getting to the rail road; a long and expensive tramway having to be kept in repair. The mine has been for some time, and is now, worked by Mr. D. C. Bozeman. The coal has an excellent reputation for blacksmithing purposes.

Alabama Mining and Manufacturing Company.

This company was organized in 1 74, and made a lease of the coal lands of the Red Mountain Iron and Coal Company. The Wadsworth or Eureka Mine, on this property was opened in 1867 by F. L. Wadsworth and others; the slope was sunk one hundred and eighty feet and gangways driven. These parties discontinued operations in 1868, for want of transportation. From 1868 to 1872 the Red Mountain Iron and Coal Company worked the mine, producing only a small amount of coal each year.

In 1872 the mine was leased to Messrs. Leavett and others, who erected an engine, pump, and other necessary appliances. These parties worked one season, and were succeeded in 1874, as above stated, by the Alabama Mining and Manufacturing Company.

This company has sunk the slope one hundred and ten feet further, and turned off a second lift, and are now mining about thirty tons per day, the capacity of the mine being about eighty tons per day. Preparations are being made to mine extensively with convict labor. The seam is a little irregular and the coal somewhat soft; but from analyses and tests made at the Eureka Iron Works, it is ascertained to be a very fine coking coal, and it is the intention, when these furnaces go in blast, to use the coke made from this coal as fuel. The machinery, shoots, and buildings at these works are arranged for a very extensive business, and are well worthy of examination. The plant here is in many respects, superior to any in the State.

Davis and Carr's Mine.

This mine was opened in 1871 by drifts. In 1873 the proprietors opened a slope a few yards distant from the rail road. The angle of dip here is about 25 degrees, and the slope is sunk 290 feet. This mine is on the south dip of the Cahaba seam, the Cahaba mine being, as was stated above, on the north dip, and about one-fourth of a mile distant southward. The coal is similar to that of the Cahaba mine, being regarded as a very fine coal for household purposes, and meeting with a ready sale. The thickness of the seam averages about three feet, and it has an excellent roof. The water and coal are hoisted by an engine of about twenty horse power, and the capacity of the mine about 8,000 tons per year.

Messrs. Byram and Bowers.

This firm has been working at two points upon the Helena seam since 1872, about one mile south-west of Helena; the old drift having been opened during the war, by the Red Mountain Iron and Coal Company. They also work a slope which connects with this drift, the coal being hoisted by means of a whim. Very little is done at this mine, except during the winter season; the coal is hauled by wagons to Helena.

The seam averages at this point three feet nine inches in thickness, and is a superior household and furnace coal, very free from sulphur. The capacity of these openings is about twenty tons per day.

During the year (1875), Mr. D. C. Bozeman has commenced sinking a slope on the Little Pittsburgh seam, near an old drift which was also opened during the war by the Red Mountain Iron and Coal Company. The seam at this point is about two and a half feet thick, very hard, and an excellent lump coal.

An opening was made in 1874 upon the Shortridge seam, in section 20, a drift being driven in at the water level, about 200 yards. The coal was used to supply the Helena Rolling Mill, (Central Iron Works,) where it gave great satisfaction.

The vein is about three and a half feet thick at this poin the coal is hard, and makes an excellent coke.

COOSA FIELDS.

These fields being at a distance from any rail road, and tl Coosa river not being navigable, have been very little e: plored. Some coal was mined years ago from the beds of tl streams crossing this field, and carried during high water, l means of boats, to Montgomery. Some mention is made this field in Prof. Tuomey's Reports, to which the reader referred.

In 1863–64 Capt. Schultz of the Confederate army made large quantity of coke from the seams in this field, getting to market by floating it down the river in flats to the rail roa bridge across the Coosa, whence it was carried by rail Montgomery and Selma. This coke was said to be the fine ever made in the State, and to equal the very best Englis cokes.

There are three seams known, the thicknesses of which a three feet, four feet, and three and a half feet.

The proximity of these fields to the vast deposits of ir ore along the Selma, Rome & Dalton R. R., as well as to tho lying between the rail road and the river, along Choccoloc creek, and also to the beds at the very edge of the fields ther selves, makes it highly important that an early and thorou survey of them should be made.

The probabilities are that the supply of fuel for workin up these iron deposits east of the field will be derived fro these beds. A rail road twenty miles long would open the to the world.

WARRIOR FIELDS.

The immense extent of this great basin, estimated to co tain at least 5,000 square miles of coal rocks, the comparati wildness of the country, and the fact that systematic explor tions have been confined to the southern and eastern edg of the field, make it impossible to note anything more tha those developments which have been made along the ra roads which skirt the eastern and southern edges of this are

Proceeding north from Birmingham, a distance of nine miles, we enter the Warrior Coal Basin. At this point the Newcastle Coal and Iron Company's mines are situated.

Newcastle Coal and Iron Company.

This Company was organized in 1873. A slope was sunk upon the Milner or Newcastle Seam, 600 feet in depth. This slope has a double track, and also a man-way and pump-way. The coal is hoisted by means of an engine of 20 horse power; the water by a steam pump. The dip of the seam is about 5 deg. to north-west, flattening as we continue down the slope. There are two lifts; the average thickness of the seam is five feet eight inches. The coal is in three benches; the lower bench is twenty-eight inches thick, followed above by six inches of slate, then by a stratum of coal averaging six inches in thickness, then another layer of slate from two to six inches thick, and then another fine bench of coal twenty-eight inches in thickness. The roof of the mine is exceedingly good. At present the mine is worked by hired labor, although convict labor has hitherto been employed with success. The method of extracting the coal, is to bear in between the two benches, throwing the slate to the rear, then allowing the upper bench to fall across the whole face of the room, and lifting the lower bench by means of wedges. This mine has the largest capacity of any in the State, and could easily turn out 300 tons per day; 60 tons per day being extracted at this time. A test slope was also sunk upon this seam, a few hundred yards south of the main opening, to a depth of 230 feet, the seam proving precisely the same there as at the main opening.

The outcrop of the seam is on the western side of the rail road, and about twenty feet above the track.

The Company owns about three miles of outcrop along this seam. The difficulty of keeping the coal free from shale has, to some extent, impaired its value.

Washing the coal would free it from this shale, and from any pyrites that might be found in it, and the cheapness with which the coal can be mined would render the erection of machinery for this purpose practicable.

A very fair quality of coke has been made from this coal, without washing. On the opposite side of the rail road, a few hundred yards south of the Newcastle mine, the Company has opened the Black Creek seam. This is reached from the rail road by a tram-way 1,200 feet in length; the immediate approach to the seam is through a tunnel driven through the top rock of the seam, 100 feet in length. Gangways are turned north-east and south-west along the seam; the coal is worked in rooms twenty-five feet in width, upon what is known as the *pillar and stall* system; the average thickness of the seam is two feet ten inches clean coal, and the "lift" averages 350 feet, gained by this tunnel; the dip is the same as that of the Newcastle seam. The seam is underlaid by soft fire clay, which enables it to be under cut and wedged down without the use of powder. The roof is fire clay, and is noted for the immense quantity of beautiful fern impressions contained in it.

This coal having a large percentage of fixed carbon, is an excellent blacksmithing coal; for gas making it is pronounced equal to Pittsburgh coal; tests made with it at the Nashville gas works show a yield of 4.95 cubic feet of gas per pound—lump coal being used. Its evaporating power is stated to be 8.10 pounds of water to the pound of coal. The Company is utilizing the slack by making it into coke, which brings twelve cents per bushel at the mines. The mine is worked by convict labor, which has proved satisfactory. The output at present is 70 tons per day.

Jefferson Coal Company.

This Company started in the spring of 1874, on what is known as the Jefferson seam. The mine is located in S. 36, T. 14, R. 3, W., about ¼ of a mile south of the rail road bridge across the Warrior river. It is owned and worked by Messrs. Myer, Morris & Co. An extensive side track has been put in, fine shoot erected, and an engine and pumps of the best kind provided.

The mouth of the mine is about seventy-five feet below the track; an inclined plane has been built to the mouth, and a

slope continued through the sandstone rock to the seam. The coal lies nearly horizontally, rising slightly to the east, it being in the basin, and this is the only mine worked in the basin proper, the other being upon the outcrop.

The seam is nearly three feet thick. Operations were suspended here in September, 1875, with a view of sinking a shaft near the rail road in order to work to better advantage, as during freshets back-water from the Warrior river reached the mouth of the slope. While in operation, the company mined about 5,000 tons of coal.

The Black Creek seam is supposed to be about sixty feet below this—the Warrior seam underlying the Black Creek.

The Company owns 300 acres of land in the basin.

Mines at Warrior Station.

After crossing the Warrior river, we find ourselves on the northern edge of the basin.

Mr. James T. Pierce, upon the completion of the S. & N. Ala. R. R. in 1872, commenced operations upon the Warrior seam, at a point one mile north of the Warrior station. The seam here dips slightly to the south, and drifts are run in all along the outcrop. The output has been from thirty to fifty tons per day up to the past summer (1875), when a side track, half a mile in length was put in by the rail road company, and eight or ten new openings made. The coal is used by the rail road company in their engines and is an excellent steam coal. The present production is over one hundred tons per day, (on December 14th, one hundred and fifty tons were mined and shipped). The seam varies from two to two and a half feet in thickness, and has a good roof; the coal is rather soft, but excellent for blacksmithing purposes.

Near the station, and on the western side of the rail road, two other mines are located upon the same seam. Both were opened in 1873—the one by Mr. O'Brien, the other by Messrs. Moss and Hogan. These parties worked the mines, producing from twenty to thirty tons per day each, until the spring of 1875, when their mines were purchased by the Alabama Mining and Manufacturing Company. Extensive im-

provements have been made by this company, a long tram way built, an excellent shoot erected, &c. The present production is seventy tons per day.

Before leaving this part of the field, it may be of interest to notice that a short distance above where the rail road bridge crosses the river, coal was mined from the bed of the river as long ago as 1836, and carried by barges down to Mobile. Mention of these early operations will be found in the Reports of Prof. Tuomey.

It remains now to speak of the mines along the A. & C. R. R. Very little has been done here, and no accurate information has been obtained. There are, however, mines at Clements' Station, Caldwell's Station, and one other point in this vicinity. The coal is obtained by means of drifts, and is hauled by wagons to the rail road, where the openings are not immediately upon the road. The seam at Clements' is said to be two feet thick, and is a fair article for domestic use. The amount produced will probably not exceed 2,000 tons per annum. The coal at Clements' Station is obtained from sections 1 and 2, township 22, range 8 west, and hauled about a mile to the rail road.

In the vicinity of Tuscaloosa, coal has been mined and used by the inhabitants for more than forty years. For an account of the earlier operations here, the reader is referred to the Reports of Prof. Tuomey.

There are no mines here at present, that do more than supply the local demand.

Upon lands belonging to the Insane Hospital, a shaft over sixty feet deep has recently been sunk by Messrs. Keene and Finley of Tuscaloosa.

In 1873 a company was organized under the name of the *Tuscaloosa Mining and Transportation Company.*

A large number of Welsh miners came out from Pennsylvania. Considerable prospecting was done in the vicinity of Hurricane creek, a tributary of the Warrior; but the company has never gone into active operation.

Below we give an extract from a report upon these lands,

made by Prof. N. T. Lupton and the present State Geologist, Dr. Smith. Some of the most instructive of these local outcrops are given in the sections following:

Section 1 is on north-east corner section 9, township 20, range 7, west.

Section 2 is on south-west corner section 18, township 20, range 7, west.

The two sections are given side by side:

	I.		II.	
Shale and Sandstone	——	7 feet 8 in.	——	9 ft. 8½ in.
Coal	13 inches		17 in.	
Shale	3 "		2 "	
Coal	9 "		9½ "	
Shale	2 "		1½ "	
Coal	7½ "		10 "	
Shale	2½ "		½ "	
Coal	15 "		12 "	
Fireclay part'g.	22 "		36 "	
Coal	19 "		28 "	
Fireclay	——		——	

In section I, (7 feet 8 inches,) there are 5 feet 3½ inches of clear coal. The coal from this outcrop is well known to Tuscaloosa to be good, as it has been carried to market there. The lowest stratum, 19 inches, furnishes the best coal, which is very firm, though so much exposed.

In section II, there are 9 feet 8½ inches, with 6 feet 4½ inches of clear coal. This exposure was made by the miners, and has been worked for coal.

The close correspondence in the succession and thickness of the different strata, leaves very little doubt that we have here two sections of the same coal seam.

In the case of the other coals whose outcrops we examined, it was impossible to obtain the data sufficient to enable us to give, with absolute certainty, a section which would represent the succession of the different beds in a vertical direction; with one exception, which is given in sections III, and IV below; thus, on section 27, township 20, range 7,

west, on a small branch, tributary to Hurricane creek, we obtained the following:

III.

Sandstone roof	——	3 feet 2½ inches.
Coal	20 in.	
Shale	1 in.	
Coal	7½ in.	
Shale	1 in.	
Coal	9 in.	
Fireclay	——	

Three feet 2½ inches, with 3 feet ½ inch clear coal. This coal is also known to be of excellent quality, as it has often been sent to the market in Tuscaloosa.

On the same branch, some distance further down stream, and about fifty feet vertically below, is another seam, of which the following is a section of the outcrop:

IV.

Sandstone roof	——	2 feet 9½ in.
Coal	19½ in.	
Shale	1 in.	
Coal	13 in.	
Fireclay	——	

Two feet 9½ inches with 2 feet 8½ inches clear coal, the quality of which is likewise excellent.

Here we have undoubtedly two distinct seams of coal, separated by about 50 feet of intervening strata—each seam with a good sand-stone roof.

As the character of a seam of coal over limited areas, is in general, remarkably constant, sections I and II, in our opinion, represent another distinct seam, though the means for the absolute determination of this point was not at hand.

Another outcrop V, (section 19, township 20, range 7, west,) showed 28 inches of clear coal, without shale, and in section 1, township 21, range 8, west, is another exposure, VI, of about 36 inches clear coal. Coal has been mined from both these outcrops, and sent to Tuscaloosa, and its good qualities have been sufficiently well tested.

From the enclosures of the coal, and its quality at the two exposures, we consider them to be sections of the same seam,

the position of which is probably between the seam represented by sections I and II, below it, and that represented by III above."

II. Geological Features of the Fields and Character of the Coals.

CAHABA FIELDS.

A most accurate and thorough survey of the southern part of these fields was made some years ago by Mr. Joseph Squire, of Helena, Ala. A map embodying the results of this survey, was drawn by Mr. Squire, and it is the basis of all the maps of this region now extant. We hope to publish this map at an early day.

The extent of the country examined, its roughness, (it being covered by an unbroken forest,) the almost complete absence of any accurate information concerning the field, made the survey extremely difficult. It is, indeed, a monument of patient and accurate work, and Mr. Squire deserves the greatest credit for the manner in which he has carried it out. As we cannot reproduce the map here, at this time, we will indicate the positions of the different series of coal seams, with sufficient accuracy to enable the reader to lay them down for himself.

Upper or Montevallo Group.

The seams of this group are found on the southern and south-eastern edge of the Cahaba field; they dip at a high angle, (nearly vertically,) towards the south; but there is also a small basin, known as the Montevallo basin, formed by several of the lowermost seams of this group.

The highly inclined series begins in the south-west ¼ of S. 19, T. 22, R. 3, west, runs in a southwesterly direction for about three miles to the SE. ¼ of S. 2, T. 24, R. 11, E., thence due west for 3 miles to S. 5, then turning a little towards the south-west again, they disappear near Alligator creek. A small patch, of a still higher series, is found in sections 5 and 6 of T. 24, R. 12, east; but these seams are too close to the

great fault which cuts off the coal measures, to be of much value.

Lower or Cahaba River Group.

The seams of this group, from the lower end of the field up to Helena, follow in general the course of the Cahaba river, *i. e.*, north-easterly, being mostly found on the south-eastern side of that stream.

A survey of this part of the fields, was made by Mr. Richard P. Rothwell, one of the editors of the Engineering and Mining Journal, published in New York. The results of this survey were presented in a paper read before a meeting of the American Institute of Mining Engineers, held at Easton, Penn., in October, 1873, and subsequently published in their transactions.

This is the best account of the Alabama coal fields which has yet been made public; we have, therefore, requested and obtained from the author, permission to reproduce it here.

ALABAMA COAL AND IRON.

BY RICHARD P. ROTHWELL, M. E.

A reference to the geological map of Alabama shows the coal measures of that State to form three distinct fields. The Coosa, or most easterly, contains about 100 square miles; the Cahaba, or middle field, which is also the most southern true coal in the United States, contains about 230 square miles and the Warrior field, which contains in the State of Alabama some 5,000 square miles, is the southern extremity of the great carboniferous deposit, which extends through Pennsylvania, West Virginia, Kentucky, Tennessee, and Georgia.

But very little has yet been done towards developing these coal fields, partly owing to the absence of all commercial manufacturing enterprise in the South under slavery, and partly owing to the want of capital and the disturbed condition of the South since the war.

During the past three or four years I have devoted a large part of my time to the examination of the coal and iron ores of this range, and particularly to the coal in the Warrior and Cahaba fields, and the iron ores which are found in such abundance in their vicinity. My surveys and examinations have been directed especially to the Cahaba field, which, from its geographical position as the most southern coal in the State, and the most accessible by water communication, counting the Alabama river as the only available stream at present, and on account of its presenting the greatest variety, and, I believe, the best quality of coal easily accessible, will undoubtedly be the center of a large industry, and must, in the near future, become one of the principal coal producing districts in America. * * * * * * * * No developments of any value have been made in the Coosa field, beyond proving the fact of the existence of several workable beds of coal, which were exploited some years ago for the supply of the blacksmiths in the vicinity.

The Coosa river could be made navigable only by a large expenditure of money, building locks and dams, and the coal basin is not crossed by any rail road. The Selma, Rome & Dalton Rail Road passes near the southern edge of this field, and the South and North Alabama road follows up the limestone valley, which lies between this and the Cahaba field.

At the base of the coal measures in Alabama, as in other portions of this country, we find a series of hard, coarse-grained, heavy-bedded sandstones. They do not, however, resemble the conglomerate we find at the base of our anthracite coal measures, nor are they even as coarse as the sandstones which lie below the West Virginia coals, on the Sewell mountain and the New river, but they have the same effect upon the topography of the country; for being much harder than the rocks immediately containing the coal beds, they form a well defined ridge, running in an almost straight north-east and south-west line, as the western limit of the Cahaba field.

The dip of these rocks does not usually exceed twelve de-

grees, and is frequently less than ten. Crossing the field in the direction of the dip, (*i. e.*, south-east,) and limiting our remarks to the southern portion of the field, where the measures are regular and the width of the field greatest (about twelve miles), we note that the inclination of the measures increases from six to ten degrees on the western limit, to twelve or fifteen degrees on the Cahaba river, in the vicinity of the Lily Shoals, and from that to the eastern limit of the field the dip increases much more rapidly, though still with tolerable regularity, till along the eastern edge of the field the rocks are dipping from 45 to 75 degrees, or even vertical in a few places, the dip being constantly in a south-easterly direction. The Cahaba coal field is limited on its southern and eastern sides by a fault which cuts off the coal measures, and brings to the surface, on a level with the highest coal beds of the field, Silurian rocks* which belong fully 7,000 or 8,000 feet below them. The vertical displacement of this enormous throw or fault must, therefore, be but little less than 10,000 feet, or nearly two miles. I know of no other such fault in any other part of the world.

The Silurian rocks, which have also a steep southeast dip, are for the most part limestones, metamorphosed by the action of the agents which caused this great rupture of the earth's crust, and cherts, which evidently have replaced limestones, and are, in many places, pseudomorphs of calc spar, and contain occasionally characteristic silurian fossils. * * In hardness, these rocks do not vary greatly from the softer sandstones, and coarse and loose pebbly conglomerates which here constitute the higher coal measures, and we do not, therefore, find any very marked ridge along the southern and eastern sides of the field as we do on the west, and as we would find, were this field really a true trough-shaped basin, instead of being a monoclinal basin as it is. This very remarkable feature exerts a notable influence in the economic value of the field. In the first place, we have here a much greater thick-

* The Silurian rocks thus brought up to the level of the coal measures belong to the subdivision known as the Knox Sandstone, probably the equivalent of the Calciferous Sandstone of northern States. E. A. S.

ness of measures than exists anywhere along the eastern [western? E. A. S.] side, and probably in any part of the great Warrior field, which is a true trough-shaped basin, with a very moderate inclination of the measures. The greater inclination of the Cahaba beds causes them to outcrop within a limited area, and as we have here a greater total thickness of measures, so we have a greater number of coal beds, and, consequently, a greater variety of coals than, I believe, exists in any part of the Warrior or Coosa fields.

It is true, however, that there is more coal which can be worked *above water level* in the Warrior field than in the Cahaba, though, since in either case the hills rarely rise more than 150 to 200 feet above the level of the creeks, no very large amount of coal will be obtained level free. From the topographical features of the country, a rail road crossing the southern portion of the Cahaba field would be graded at a considerable elevation above the streams, the coal would have to be raised either in shafts or on planes to the level of the rail roads; there would, therefore, be the less inducement for opening mines on the lowest water level, except, of course, drainage levels. The small inclination of the beds would make it necessary to open all the lower beds by means of vertical shafts, which would be located with reference to shipping facilities on the railways. The surface of the field is very broken, valleys being cut in every direction. It is an exceedingly difficult country in which to select the most desirable route for a road; not that there are any insurmountable, or even very great, obstacles to the construction of a road with moderate grades and good alignment across the southern portion of the field, but, since the road should be built with the special object of developing the coal mining interests, it should run in that portion of the field where the largest beds and the best quality of coal is accessible at moderate depths, and where the regularity of the measures gives promise of freedom from those faults and disturbances which are so serious a drawback and source of expense in coal mining operations. These are considerations which appear to have been overlooked in the location of all the Alabama rail roads.

The surface of these coal fields is nearly everywhere covered by a virgin forest of yellow pine, oak, chestnut, and other valuable timber. The soil is light, and not suitable for agricultural purposes, except in the river and creek bottoms, which are of very limited area. * * * * * *

NUMBER AND THICKNESS OF THE COAL BEDS.

The coal measures of the Alabama fields consist of a series of sandstones, conglomerates and shales, among which we find some ten or twelve veins of workable thickness, *i. e.*, from two feet, (average thickness of clean coal,) upwards, besides a number of smaller beds, several of which are from fifteen to eighteen inches in thickness. These ten or twelve workable beds are distributed in two series or groups, as we find in all our coal fields, notably in West Virginia, Ohio, and Pennsylvania. The lower group contains seven or eight workable beds, varying in average thickness from three feet to seven feet of clean coal, and making an aggregate thickness of workable coal in the beds thus far proved of from thirty to thirty-five feet, while the upper or Montevallo series, which occupies but a very small area along the eastern side of the field, contains some three or four workable beds, giving an aggregate thickness of about twelve feet, making the total thickness of coal in the field, in beds of workable size, at from forty to fifty feet.

The enormous thickness of measures which exists between the lower beds of the lower series and beds in the Montevallo or upper group, renders the lower coals so deep as to be forever inaccessible where we have the upper beds—hence, the *maximum available thickness* of coal as yet proved in any portion of the field will not exceed thirty to thirty-five feet; while, if we take the area of the Cahaba field at 230 square miles, the average thickness of workable coal over the entire field would probably scarcely attain fifteen feet; for in a great part of the field along the western side, where the measures are nearly horizontal (5 deg.—10 deg.) there are but two workable beds. This estimate, so much lower than we have been accustomed to see stated in reports and newspaper arti-

cles, is probably not very different from the thickness which the same method of estimating would give for any of our other bituminous coal fields.

Without describing in detail the peculiarities of the different veins, which would be out of place in a general paper of this kind, though of very great importance in determining on the establishment of mines, I may say that the veins of the Cahaba coal field are generally free from shale partings, that is, they form generally a single bench of coal, and in that respect will be found better adapted for clean mining than most of the beds of the Warrior field, where some of the larger veins have a number of shale bands running through them. The thickness of the largest bed, as yet proved in the Cahaba field, is about nine feet, but where examined, two feet of these nine formed a shale band, leaving the coal in two divisions of about five feet six inches, and one foot six inches; where, unfortunately, the thick bench comes on the top, the probability, therefore, is, that the lower bench will be abandoned.

Another vein, worked to some extent during the war, is represented to have a thickness of seven feet of clean coal. The good quality of the coal from this place is quite evident, for there still remain at the pit-head several hundred tons of it in large lumps, which have resisted very successfully the action of the atmosphere for some eight years now, having been all that time exposed to the sun and rain of a warm climate; and it is still so serviceable a fuel that many of the farmers send for miles to get it for their winter supply.*

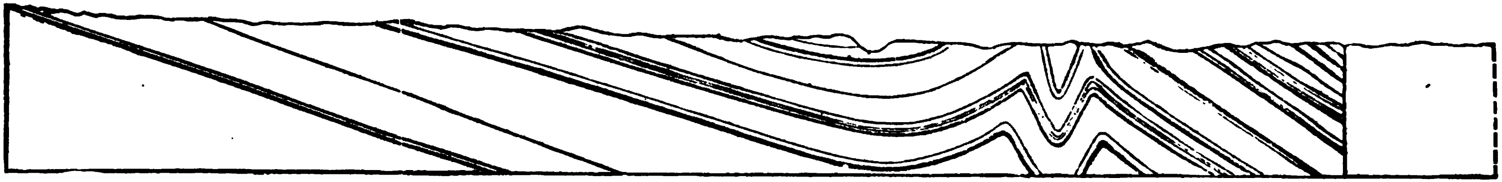
The accompanying sections, one across the southern or widest portion of the field, the other across the basin on the line of the South & North Alabama Rail Road, will give the general features of this field, and show the remarkable fault which limits the coal field on the south and east.

*The two seams here mentioned, are the Big Seam, and the Gholson Seam, Thompson's Lower Mine on the latter, being the one specially referred to.

E. A. S.

CAHABA COAL FIELD.

SECTION ON S.& N. R.R.



SCALE ½ MILE TO AN INCH.

SECTION ON FOUR MILE CREEK.

SCALE 1 MILE TO AN INCH.

The South & North Alabama Rail Road section shows, also, one of those peculiar contortions in the rocks which we frequently find in the coal fields; it is very well defined at this point, and has the effect of greatly interfering with mining operations, for such plications are the results of a crushing of the measures which makes the coal faulty and not unfrequently sulphury, even at some distance from the anticlinal and synclinal axes.

In general we may remark that wherever the disturbance of the measures is so great as to leave the beds standing at a high angle, say 60 to 80 degrees, or vertical, we almost invariably find the veins are subject to great irregularity, both in the thickness and hardness of the coal; they are, in short, "faulty," and this is as true in the anthracite as in the bituminous fields. The rolls which we find in the narrow, compressed part of the field where the South & North Alabama Rail Road crosses, disappear, or at least, so diminish in importance in the southern portion of the field that they cannot be designated as anticlinals, for they do not divide the field into separate basins. On the "Four Mile Creek" section to which I refer, these rolls barely change the degree of the dip over a very limited distance from, say twenty degrees to horizontal, or nearly so. Undoubtedly they will exert an influence on mining operations, even though they are not of such magnitude as to divide the field into different troughs or synclinal basins; their position in the field, especially in that portion of it where the most desirable coals are accessible, has received much attention in examination, but to name these points without reference to an elaborate map would be of little interest.

The following are the workable beds proved on or near the line of the South & North Alabama Rail Road. I place them in their order of superposition, commencing with the highest, the thickness being the average of clean coal where examined:

*No. 9.	Thickness.	.4 ft. 0 in.	No. 4.	Thickness.	.3 ft. 6 in.
" 8.	"	..3 ft. 6 in.	" 3.	"	..3 ft. 3 in.
" 7.	"	..2 ft. 0 in.	" 2.	"	..4 ft. 0 in.
" 6.	"	..2 ft. 0 in.	" 1.	"	..3 ft. 6 in.
" 5.	"	..2 ft. 6 in.			
Aggregate thickness					.....28 ft. 3 in.

It is true that at this point the measures are compressed, and these veins may become thicker as we get some distance away from the line of the greatest disturbance, in fact, in the southern portion of the field, we find the beds much larger, there being but little disturbance there. The developments thus far made are not sufficient to enable us to identify the beds in different parts of the field, but I give an approximate section of the measures in the "Four Mile Creek," as follows:

†4 veins Montevallo Group, ag'te	12 ft. 0 in.	V vein,	3 ft. 6 in.
VIII vein....................	3 ft. 6 in.	IV "	8 ft. 6 in.
VII "	7 ft. 0 in.	III "	3 ft. 6 in.
VI "	4 ft. 0 in.	II "	4 ft. 0 in.
		I "	4 ft. 0 in.
Total.................................			50 ft. 0 in.

There are probably other workable beds not yet known. We can assume the thickness of coal in the southern portion of the field at 35 to 40 feet in the lower group, and about twelve in the upper group.

The great fault, which limits this coal field on the east, has left none of the upper groups of coals, and, probably, not

*For the sake of reference I give below the names of the Seams corresponding with the number given by Mr. Rothwell. T. H. A.

No. 9. Helena Seam.	No. 5. McGinnis' or Black Shale Sm.
8. Conglomerate, or Beaver Dam Seam.	4. Buck Seam.
7. Little Pittsburgh Seam.	3. Cahaba Seam.
6. Moyle Seam.	2. Cahaba Seam.
	1. Gould Seam.

†The names of several of the veins, corresponding to the above numbers, are given for convenience. T. H. A.

VII vein is at Thompson's Lower Mine on the Gholson vein.

VI vein is Gholson vein at Daly's Creek.

V vein is the Coke vein.

IV vein is the Big vein.

even the two highest veins of the lower group, on the line of the South & North Alabama Rail Road.

While our data are not sufficient to identify the several beds in the different parts of the field, yet the dimensions of the veins I have above given are from openings made mostly during the war, when the needs of the Confederate Government caused it to make extensive surveys and examinations of the field, (the notes of these were unfortunately destroyed during the latter part of the war,) and to open mines in a number of places.

The fact is, therefore, fully proven that Alabama possesses an abundant supply of coal in easily accessible beds of good workable thickness. I have made careful examinations of the quality of the coal of all the workable beds where it was possible to obtain satisfactory samples for analysis. I was unable in most cases to procure very large amounts of the coals, as would have been desirable; for the only manner in which to obtain samples whose analyses will give the average quality of the bed, is by taking a large number of freshly mined average specimens from the different divisions of the vein, and by crushing and mixing them previous to taking the samples for analysis. In some cases it was impossible to do this, so that, though care was taken to get what appeared average pieces, it is possible the run of the bed would not equal the analysis I have given. As a means of comparison with coals from other fields, the results will probably be satisfactory, for in most cases samples for analysis are taken in the same manner as were these, and the published results consequently indicate almost invariably a quality of coal superior to the average production of the mines. It is also essential that the coal be freshly mined, for experiments have been made that show that the deterioration which coal undergoes by even a very limited exposure to the atmosphere is quite considerable. For example:

According to Dr. RICHTER the *weather waste* of a coal depends upon its ability to absorb oxygen, converting the hydrocarbons into water and carbonic acid.

GRUNDMAN found that coal exposed for nine months to the

atmosphere lost fifty per cent. of its value as a fuel. He states that the decomposition takes place in the middle of a heap the same as on the surface, and it reached its maximum about the *third* or *fourth* week; and one-half the oxygen was absorbed during the first fourteen days. He also found that a coal poor in oxygen absorbs it most rapidly, and that the presence of moisture is an important condition. Coal which made, when freshly mined, a good compact coke, after eleven days exposure, either would not coke at all, or it made an inferior coke. For gas purposes the coal is also greatly injured by the loss of its volatile hydro-carbons.

VARRENTRAPP, of Brunswick, found in his experiments that oxidation of the coal takes place even at common temperature, where moisture is present. Coal exposed to a temperature of 284 degrees, Fah., for three months lost all its hydro-carbons, a fact which shows that the conversion of bituminous coal into anthracite was not necessarily accompanied by a high temperature. He found, also, that the weather waste in some cases amounted to thirty-three per cent., and in one instance the gas-yielding quality decreased forty-five per cent., and the heating power forty-seven per cent., while the same coal, under cover, lost in the same time, but twenty-four per cent. for gas purposes, and twelve per cent. for fuel.

The harder varieties of bituminous coal, such for example as the cannel and splint coals of West Virginia, Ohio, and Indiana, do not appear to lose much by exposure to the atmosphere, except it be in heaps of slack where the conditions are favorable to the generation of a high temperature. Anthracite appears to be still less affected by exposure, for the fine coal which has lain for the last twenty years in our culm banks, exposed to the rain, and under conditions the most favorable for decomposition, being mixed with shales containing a large amount of iron pyrites which in decomposing generate a very high temperature in the whole mass, is yet found to burn well, almost as well as that freshly mined, while the large lump coal has been used in our blast furnaces after an exposure of twelve years, and no perceptible difference in its quality could be noticed. It is nevertheless quite certain that

most varieties of bituminous coal deteriorate very rapidly, and to an extent but little appreciated.

These important results should be borne in mind, not only in providing for the storage of coal, but also in selecting samples for analysis.

The following table gives the composition from some seven or eight different beds. (The numbers of the samples and the beds from which they are taken are given on the same page. T. H. A.) These analyses, made with much care, will be found of value and interest, and though only a part of those I have made, they may be taken as representing fairly the quality of the Cahaba coals:

CAHABA COALS—R. P. BOTHWELL.

	Numbers of Samples. 1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	Mean of 10 analyses of Cahaba coals from 8 veins.	Mean of 14 analyses of Indiana coals.—Cox.	Mean of 6 analyses of Ohio bl'k coals. Newberry.
Specific gravity	1.22	1.29	1.29	1.38	1.29	1.28	1.12	1.28	1.25	1.35	1.26	1.24	1.266
Moisture	1.66	1.58	1.91	1.93	2.05	2.13	2.54	1.78	2.14	2.13	1.98	5.2	4.54
Volatile Combustible Matter	33.28	32.60	32.65	32.84	33.47	30.86	29 44	30.60	31.92	27.03	31.47	34 8	34.61
Fixed Carbon	63.04	62.62	63.91	59.64	62.20	64.54	66.81	66.58	63.68	66.22	63.92	57.2	58.68
Ash	2.02	3.20	1.53	5.59	2.28	2.47	1.21	1.09	2.26	4.62	2.63	2.6	2.17
Total	100.	100.	100.	100.	100.	100.	100.	100.	100.	100.			
Sulphur as Sulphate	.097	.223	.071	1.001	.118	.320	.073	.085	......	.114	} 1.06	......	0.87
Sulphur as Sulphuret of Iron	.428	.727	.559	2.779	.523	1.160	.455	.479	......	.388			
Sulphur in Coke	......	......	......	......	......	......	.214	.223	......	......			

"Connelsville Coke," Pa. .... 55 to 70 per cent.

Sample No. 1. From Cahaba Vein—Davis' Mine.
" 2. " " " Holt's Mine.
" 3. " Black Shale Vein—McGinnis.
" 4. " Moyle "
" 5. " Little Pittsburgh Vein.

Sample No. 6. From Conglomerate Vein.
" 7. " Helena "
" 8. " Coke "
" 9. " Gholson "
" 10. " Montevallo "

The above table shows that the Cahaba coals are of remarkably fine quality, being chiefly distinguished for their dryness, small amount of ash, and large amount of fixed carbon. We note particularly (as a subject worthy of further attention, and on which I desire to have the experience of other members) the regular increase, with but little exception, of the amount of moisture in the coal as we go from the lower to the higher veins; it would appear that, possibly, with a sufficient number of analyses of freshly mined coal, we might be able to determine the relative height in the series of the several veins of any given field, by this test alone. I believe it has been asserted that the quantity of oxygen in the coals of a given basin varies directly with the geological height of the vein. Unfortunately I was not enabled to apply this test, but it is a matter of great interest, if by careful analyses, we can determine the relative ages of coal beds of the same field, and possibly even of different fields.

Some of the above coals make an excellent coke suitable for blast furnace use, and as some of them are dry burning coals that do not coke, they would probably work raw in the furnace. Judging from the analyses alone, we would be inclined to consider all of the Cahaba as drier burning coals than those of Indiana or Ohio, while in reality the opposite is the case. The block coals of Ohio and Indiana, so largely used in the furnaces of the Mahoning Valley, do not coke in burning, while the Cahaba coals do, though the former contain about three per cent. more of volatile combustible matter, and nearly six per cent. less fixed carbon than the latter.

It is noticeable that these Indiana and Ohio coals, ranked among the best furnace fuels we have in this country, contain on an average two and a half to three per cent. more moisture than the Alabama coals; in fact, the analyses would indicate that the Cahaba coal is a better fuel, and altogether an exceptionally pure coal. It has been fully proved as a steam generator, and the coke from several of the veins was used very successfully in the smelting of iron for the cannon foundry of the Confederate States, at Selma, during the war.

It may be found that it will be desirable in the case of a few

of the good coking seams to crush and wash the coal before coking, and this will be more necessary in the Warrior field than in the Cahaba, the veins proved in the former containing more soft shale partings which, in the mining, will break up and can not be separated from the coal.

The coals of the Warrior field appear also to be softer and more friable in general than those mined on the Cahaba.

The property which makes one coal cake or melt in burning, and another burn without change of form, is not to be determined by their composition alone, for we find coals almost identical in chemical composition, as are these Cahaba coals, and yet one cokes well, making a hard, compact, silvery coke, and another burns without change of form. It appears to me that probably in non-coking coals the carbon is in thin layers which are separated by exceedingly thin leaves of a carbon which has lost its volatile constituents. We not unfrequently find in the "partings" between successive layers of both bituminous and anthracite coal layers of charcoal—mineral charcoal, if we may so call it. And again, we know that on heating a piece of the hardest anthracite with the most perfect conchoidal fracture, we can readily distinguish under the microscope the original bedding planes of the coal, and can usually even divide the piece into leaves.

Now, where these leaves are separated by thin layers of what we may call oxidized coal—that is, coal which, from exposure, or other cause when being deposited, has lost a portion of its volatile constituents, bringing it to the condition of this mineral charcoal, it is probable the coal would not melt or cake in burning even where the amount of coal in the partings is so small that it would not change noticeably the composition of the entire vein, while where the bed was deposited in a continuous manner or without these partings of non-coking carbon, we would have a non-coking coal.

The Cahaba coals contain a small amount of sulphur, principally in the form of sulphuret of iron.

I have determined separately the amount contained as sulphate of lime, alumina, &c., since in that condition it is not supposed to exercise the injurious influence in the blast fur-

nace which it does when occurring as sulphuret of iron. The quantity of sulphur contained in these coals varies considerably, but the best veins are sufficiently free from it to be suitable for use raw in the blast furnace where the nature of the coal in other respects will allow of this, and in all cases they are so free of sulphur as to produce coke of great purity.

The cost of mining in the Cahaba and Warrior fields will vary for the different veins, according to their thickness, the amount of shales, interbedded in the coal, the nature of the roof of the vein, the location of the veins, and other conditions of a practical nature, which will require careful consideration for each particular case. For a large output the cost should not exceed $1.75 per ton in the rail road wagons, including in this, interest and wear and tear of improvements, but not royalties, for where the land can be bought at from $3.00 to $10.00 per acre, it is not necessary to count royalty or sinking fund for the property, the increase in the value of the surface much more than covering the first cost of the land. * * * * *

The concluding part of this paper, relating more especially to the iron deposits, we have omitted. T. H. A.

Through the courtesy of Mr. Walter Crafts, of the Shelby Iron Company, we are enabled to give additional details derived from Mr. Rothwell's report to that company, and we incorporate with the same information obtained from other sources.

Gould Seam.—The coal occurs in a single bench; thickness three feet six inches. It is soft, friable, and crumbles in handling, dull black in color, cokes well, is easily mined, but the roof is soft, and the seam irregular, often accompanied by considerable "mining."

Mr. Rothwell's analysis is as follows:

Specific gravity	1.30
Moisture	1.34
Volatile combustible matter	28.96
Fixed carbon	60.58
Ash	9.12
Total	100.00

Sulphur as sulphate............0.09	} 0.82, total S.	
Sulphur as sulphuret of iron....0.73		
Sulphur in coke................0.21		

Cahaba Seam.—The average thickness of this seam is three feet; a fine coal, without shale partings. Cokes well, and is a good steam coal.—See tables for analysis. The Wadsworth Seam is stated by Mr. Rothwell to be identical with the Cahaba. I give below an analysis of the coal from the Wadsworth Seam, by Mr. A. W. Kinzie, of the Eureka Iron Works.

The *Buck Seam* is said to contain eleven to twelve per cent. of ash, but is a very good coal for domestic use.

The *Shortridge Seam* is omitted by Mr. Rothwell from his section. It is three feet six inches in thickness, without any shale partings, is an excellent coking coal, and will answer admirably for gas making. This seam lies below the Wadsworth seam.

Moyle Seam.—A careful section of this seam shows the following:

Top—Fire-clay.

Coal........	0 ft. 3 in.
Fire-clay....	0 ft. 5 in.
Coal.	0 ft. 8 in.
Fire-clay	3 ft. 0 in.

Analysis given in tables above.

Conglomerate or Beaver Dam Seam. We have previously stated that this seam was extensively worked during the war. The seam is from three feet, to three feet six inches in thickness, but is quite irregular. It occurs in a single bench with a shale top; the quality of the coal is excellent. Analysis has been given in tables above.

Another analysis of this coal by Mr. Otto Wuth, of Pittsburgh, Pa., shows the following composition:

Water	0.30
Bitumen	31.36
Fixed carbon	65.45
Ash	2.81
Sulphur	0.08
Total	100.00

Helena Seam.—This seam has a good hard roof with shale bottom. It is the first seam belonging to the upper series above the conglomerate. The coke made from this coal is only average in quality. The extreme purity of this coal chemically, together with its structure, warrant the assertion that it would probably work raw in the furnace. The analysis is found in Mr. Rothwell's tables.

We have no more definite information of any particular interest, concerning the coals mined in the lower part of the Cahaba river group, than what has already been previously given, in our historical account, and in the reprint of Mr. Rothwell's paper.

Warrior Field.

There seems to be but little doubt that this field is composed of several basins; for want of proper explorations, however, their limits are almost entirely unknown.

The enormous thickness of the coal bearing rocks in the Cahaba field, being estimated at over 5,000 feet, has no parallel in the Warrior coal field.

We have very few analyses to give of the coals from this basin, except of those from the Newcastle and Black Creek Seams, and from seams in the vicinity of Tuscaloosa. For several of these analyses made for the survey by Prof. N. T. Lupton, the reader is referred to the Report of Progress for 1874.

An analysis of the coal from the Newcastle or Milner Seam, by Dr. Otto Wuth, of Pittsburgh, Pa., shows the following composition:

Specific gravity	1.38
Water	.50
Volatile matter	28.24
Fixed carbon	59.69
Ash	10.92
Sulphur	.64

See further; the remarks on this seam, made above in our historical account.

Of the Black creek coal, we present also an analysis made by Dr. William Gesner.

Black Creek Coal.

Specific gravity	1.36
Water	.12
Bitumen (volatile)	26.11
Fixed carbon	71.64
Ash	2.03
Sulphur	.10
Per cent. of coke	73.67

"Its physical characteristics classify it as a firm bituminous block coal, with cubical cleavage, dull vitreous lustre, and very resistive to moisture."

The value of chemical analyses of coals is only comparative, their physical structure being of equal importance. We quote here some remarks by Mr. J. W. Foster, a well-known authority, illustrative of this point.

"It would appear that a furnace coal, to have sufficient reducing power, and at the same time all the softness and combustibility of wood, should have from 58 to 62 per cent. of fixed carbon, little moisture, and few impurities. There should be such a physical structure as to prevent the bitumen from running together in the process of combustion, and cementing the mass. With these coals a greater quantity of iron, in proportion to fixed carbon, is produced, than with anthracite; the quantity of iron better, and the wear on the furnace much less destructive. The peculiar properties of iron-making coals, are dependent, not so much on the chemical qualities, as the physical structure, by which they are able to keep their form in burning."

"Analysis shows the materials of which a coal is composed, but not how they are put together. The heating power and intensity depend to a great extent on the mechanical structure."

The following approximate section of the strata in the vicinity of the Newcastle Iron and Coal Company's mines, was received from Mr. Thomas Sharp, the superintendent:

There are said to be two or three seams above the New-

castle; but the thicknesses and distances apart of these we cannot give.

Newcastle seam	5 ft.	8 in.
Sandstone.	15 ft.	0 in.
Coal.	0 ft.	22 in.
Fire-clay	3 ft.	0 in.
Sandstone.	20 ft.	0 in.
Coal.	2 ft.	6 in.
Sandstone.	25 ft.	0 in.
Black band iron ore	1 ft.	4 in.
Sandstone	20 ft.	0 in.
Coal.	4 ft.	9 in.
Sandstone.	25 ft.	0 in.
Conglomerate	not passed.	

The seam of black band iron ore, shown in the above section, is said to be of superior quality, and arrangements have been made by the Eureka Iron Company, for its use in their furnace.

III. Production—Markets and Methods of Shipment—and Future Prospects of the Trade.

No accurate record has ever been kept of the amount of coal mined in this State. From various sources, we have collated the following information upon this point:

Up to the beginning of 1874, we estimate the total production of the State at....... ....450,000 tons.

For 1874, the production was as follows:

S. & N. R. R. transported	33,139	tons.
S., R. & D. R. R. "	14,750	"
Transported over A. & C. R. R., and all other production (estimated)	2,000	"
Total for 1874	49,889	"

The production for 1875 we, of course, can not yet give; but there have already been transported over the various rail roads, up to December 1, about 65,000 tons. The total production of 1875 will probably show an increase over that of 1874, of at least 50 per cent.

The coal is transported by the rail roads to the markets, which are the principal cities of Alabama, Georgia, and Mississippi, and on the L. & N. R. R. as far north as Nashville, Tennessee.

The L. & N. and Great Southern R. R. Company is the largest consumer, using almost exclusively upon the southern half of the road, coal from the Warrior fields.

It is estimated that this company takes over 20,000 tons per annum of Alabama coal.

None of the furnaces as yet use coke in the smelting of iron; but the Eureka Company are making arrangements for its use as a fuel.

The rapid increase in the production and sale of coal of this year over last, shows that the future prospects of the trade are exceedingly favorable.

Since Cumberland coal is only $4.25 per ton at Locust Point, we can not expect to compete in foreign markets, unless we get our coal to tide-water cheaper. We can do this by shipping by rail to Montgomery and Selma, and thence to Mobile via the Alabama river. Mobile harbor has sufficient depth of water for coal-carrying vessels, and it has a great advantage over Pensacola, from the fact that return cargoes can be had to that port (Mobile).

This relieves the coal of the burden of paying freight both ways.

The writer apologizes for the fragmentary nature of this report; his purpose being only to collate and put in tangible form, notes upon the subject received from many kind friends, as well as those derived from printed articles.

A general acknowledgment is here made for the generous responses made to the writer's requests for information.

T. H. Aldrich.

The following records of borings by a diamond drill, made in the Warrior Coal Fields in Jefferson county, are of such general interest that we reprint them here:

I. Drilling at Camp Branch, ten miles west of Birmingham, Jefferson County, Alabama.

		FT.	IN.
1.	Surface soil and drift	4	0
2.	Yellow sandstone	3	0
3.	Clay or soapstone	6	4
4.	Arenaceous clay	5	0–18 ft. 4 in.
6.	Coal	0	10
7.	Clay	0	6–19 ft. 8 in.
8.	Coal	0	4
9.	Clay, light	4	0
10.	Gray sandstone, hard, micaceous	2	6
11.	Coarse gray sandstone, fossils	53	4
12.	Clay	1	0
13.	Gray sandstone	6	0
14.	Arenaceous clay	4	0
15.	Clay	4	0
16.	Arenaceous clay	6	0
17.	Hard gray sandstone	2	0
18.	Clay	3	0
19.	Arenaceous clay, fossils, plants, etc	5	3
20.	Blue sandstone, hard, micaceous	4	7
21.	Variegated sandstone	6	1
22.	Arenaceous clay	4	0
23.	Clay, with seams of coal through it	3	0
24.	Soft blue clay, mud-vein	2	0
25.	Gray sandstone, micaceous	14	1
26.	Arenaceous clay	59	5
27.	Gray sandstone, hard, micaceous	3	5
28.	Clay or soapstone	7	0
29.	Gray sandstone, hard, micaceous	16	0
30.	Blue slate, pyrites, combined	100	7
31.	Rippled sandstone, micaceous, tender	9	0
32.	Gray conglomerate	7	0
33.	Gray sandstone, micaceous	6	7
34.	Dark gray standstone, hard, micaceous	4	0–347 ft. 10 in.

35.	COAL, hard, bright, free from sulphur, as shown by core	6	0	
36.	*Fire-Clay*	3	0	
37.	Dark gray sandstone, fossils	5	4	
38.	Fine sandstone, micaceous	33	0	
39.	Arenaceous clay, filled with fossil plants	4	0	
40.	Clay and mud	5	0	
41.	Blue clay, fossils	11	0	
42.	Light clay, fossils, ferns, etc	24	0	
43.	Hard gray sandstone	8	0	
44.	Coarse hard sandstone	2	0	–449 ft. 2 in.
45.	COAL, (struck gas-vein, well flowing strong, gas on fire)	2	0	
46.	Dark gray rippled sandstone, tender, micaceous	24	0	
47.	Slate-clay sandstone, tender, micaceous	20	0	
48.	Arenaceous clay, dark, good roof	4	0	
49.	Clay, good roof	3	0	–502 ft. 2 in.
50.	COAL, hard, glossy black	4	0	
51.	*Fire-Clay*	2	0	
52.	Clay, fossil plants	4	0	
53.	Coarse gray sandstone, micaceous, bitumen	9	0	
54.	Dark slate, coal plants	3	0	
55.	Sandstone, soft, fossils	1	0	
56.	Coarse gray sandstone, micaceous	3	0	
57.	Soft conglomerate	2	0	
58.	Soft gray sandstone, bitumen, coal-seams through it	4	0	
		532	2	

II. DRILLING AT WARRIOR FOR COAL, SOUTH & NORTH ALABAMA RAIL ROAD, JEFFERSON COUNTY, ALA.

		FT.	IN.
1.	Surface soil and drift	20	0
2.	Gray sandstone, micaceous	18	0

3.	Coarse sandstone, micaceous	28	6	
4.	Dark arenaceous clay	24	6	
5.	Clay or soapstone	9	0	–100 ft. 0 in.
6.	COAL	1	2	
7.	Clay, dark	30	0	-131 ft. 2 in.
8.	CANNEL COAL AND BLACK BAND	2	4	
9.	COAL	3	4	
10.	Clay	4	0	
11.	Arenaceous clay	16	0	–156 ft. 10 in.
12.	COAL	1	8	
13.	Clay, dark	1	6	
14.	Sandstone, micaceous	3	0	
15.	Dark clay shale, coal plants	3	0	–166 ft. 0 in.
16.	COAL, hard and free from sulphur	2	2	
17.	Fire-clay, light	6	10	
18.	Soft micaceous rock	9	0	
19.	Sandstone, micaceous, hard	6	0	
20.	Arenaceous clay	51	2	
21.	Dark fossil sandy clay	48	6	
22.	Dark gray limestone, bitumen, hard	10	0	
23.	Clay	50	0	
24.	Arenaceous clay, rippled	4	0	
25.	Gray sandstone, micaceous, compact, seams of coal	6	0	
26.	Dark micaceous sandstone, slaty fracture	52	0	
27.	Clay, coal fossils	6	0	
28.	Hard, micaceous sandstone	37	0	
29.	Clay or soapstone, fossil shells	3	0	
30.	Dark sandstone, fossil shells, pearly	4	0	
31.	Dark clay, coal fossils	2	0	–463 ft. 8 in.
32.	COAL, hard and bright	1	6	
33.	Fire-clay	1	0	
34.	Hard micaceous sandstone, gray	15	0	
35.	Clay shale	1	0	–482 ft. 2 in.
36.	COAL	1	4	
37.	Arenaceous clay	7	0	
38.	Clay, coal plants	5	0	–495 ft. 6 in.

39.	COAL, splendid	2	6
40.	Clay	2	0
41.	Micaceous sandstone	16	0
42.	Arenaceous clay	6	0
43.	Hard micaceous sandstone, gray	64	6
44.	Clay or soapstone	9	0
45.	Gray sandy shale, micaceous	5	1
		600	7

III. DRIDLING AT SULPHUR SPRINGS CHURCH, SEVEN MILES WEST OF BIRMINGHAM, JEFFERSON COUNTY.

		FT.	IN.	
1.	Surface soil	2	0	
2.	Dark clay	3	0	
3.	Sandstone, gray, micaceous, hard, fossils	16	0	
4.	Arenaceous clay	3	5	
5.	Arenaceous clay, fracture vertical	3	4	—27 ft. 9 in.
6.	COAL, soft	0	3	
7.	Sandstone, vertical fracture, pyrites	6	0	
8.	Dark limestone, vertical fracture, seams of spar, pyrites	8	0	
9.	Dark clay	25	9	
10.	Clay or soapstone, pyrites	47	0	
11.	Sandstone, traces of lime, (bastard)	2	0	
12.	Bastard limestone	1	0	
13.	Gray sandstone, hard, micaceous	2	0	
14.	Gray sandstone, coal seams through it	1	0	
15.	Clay pyrites, fracture vertical	3	0	
16.	Hard dark limestone	7	0	
17.	Hard sandstone, micaceous	4	0	
18.	Clay or soapstone, fossils	5	5	-140 ft. 2 in.
19.	COAL, good	4	6	
20.	Fire-clay	3	6	
21.	Gray sandstone, hard, micaceous	9	8	
22.	Arenaceous clay	9	6	-166 ft. 11 in.

23.	Coal, good	1	4	
24.	Fire-clay	1	6	
25.	Clay, fossils	8	0	
26.	Black limestone, very hard, (bastard)	2	0	
27.	Clay, fossils	17	3	–197 ft. 0 in.
28.	Coal, and drillings of the coal	2	0	
29.	Slate clay	3	3	
30.	Clay or mud, seams of coal through it.	3	0	
31.	Arenaceous clay, fossils	1	0	–206 ft. 3 in.
32.	Coal, and drillings	1	8	
33.	Clay, fossils	1	9	–209 ft. 8 in.
34.	Coal, and drillings, good	3	6	
35.	Clay	2	0	
36.	Coarse gray sandstone, fossils	23	0	–238 ft. 2 in.
37.	Coal, sulphur balls	1	4	
38.	Arenaceous clay, coal plants	3	6	
39.	Clay or soapstone	1	0	
40.	Dark hard sandstone, micaceous	3	0	
41.	Arenaceous clay	2	0	
42.	Clay, coal plants	3	0	
43.	Dark arenaceous clay	28	0	
44.	Coarse, gray, sandstone, hard, micareous	6	0	
45.	Arenaceous clay	17	8	
46.	Clay, fossils, plants, etc	2	0	–305 ft. 8 in.
47.	Coal	3	4	
48.	Arenaceous clay.	1	0	
49.	Coarse gray sandstone	3	5	–313 ft. 5 in.
50.	Coal mixed with clay	1	8	
51.	Arenaceous clay, seams of hard black slate	8	0	
52.	Coarse gray sandstone, seams of coal.	7	0	
53.	Dark sandstone, fine, coal plants	4	0	–334 ft. 1 in.
54.	Coal	1	0	
55.	Clay, coal plants	2	0	
56.	Sandstone, micaceous	3	0	
57.	Clay	20	6	
58.	Coarse gray sandstone	6	0	

59.	Slate clay	13	0	–379 ft. 7
60.	COAL, with seams of slate and sulphur	0	10	
61.	Clay, coal plants	2	0	
62.	Coarse gray sandstone, micaceous	9	0	
63.	Conglomerate	6	8	
64.	Arenaceous clay, fracture vertical	6	0	
65.	Dark gray limestone	4	0	
66.	Dark sandstone, shells	20	0	
67.	Arenaceous clay	10	0	
68.	Dark limestone, shells	3	0	
69.	Clay, with seams of sand, stones, (broken)	15	4	
70.	Dark gray sandstone, micaceous, hard	40	2	
71.	Dark sandstone, fossil plants	12	0	
72.	Dark limestone, hard	4	0	
73.	Arenaceous clay	30	5	
		543	0	

IV. DRILLING FOR COAL AT MORRIS STATION, JEFFE[RSON] COUNTY, ALABAMA, S. & N. A. R. R.

		FT.	IN.	
1.	Surface soil, and soft red sandstone	5	0	
2.	Hard, gray sandstone, micaceous	20	0	
3.	Dark sandstone	5	0	
4.	Fossil clay	3	0	—33 ft.
5.	COAL	0	8	
6.	Sandstone	30	0	
7.	Sand, clay seams, coal through it	17	0	
8.	Fine sandstone, dark	12	0	—92 ft.
9.	COAL, soft	2	0	
10.	Fire-clay	1	0	
11.	Clay, coal fossils	3	6	—99 ft.
12.	COAL, seams of sulphur	4	9	
13.	Fire-clay	1	4	
14.	Clay	4	0	

y, hard	5	0	
enaceous clay, bitumen	9	9	
ay conglomerate sandstone, hard.	16	0	
te.	1	0	–141 ft. 0 in.
AL, mixed with slate	1	6	
enaceous clay	2	0	
rk, fine sandstone, micaceous	6	0	
ay sandstone, hard, micaceous	7	0	
rk sandstone, seam of coal in it	3	0	
rk, rippled sandstone, micaceous.	2	0	
ay sandstone, very hard	8	0	
y or mud	1	6	
arse, gray sandstone, micaceous	9	0	
te clay	33	2	
y	1	0	
y, mixed with black slate	0	8	
ht clay	8	0	
ck slate	0	6	–424 ft. 4 in.
AL, very good, hard	1	6	
rk clay	3	0	
y sandstone, dark micaceous	28	0	
e, dark sandstone	7	0	–263 ft. 10 in.
AL, very good	4	5	
y	3	0	
e, gray sandstone, hard	5	2	
te clay, fossil plants	21	1	–297 ft. 6 in.
L, and drillings of coal, very good.	2	6	
e-clay	3	0	
te clay	7	0	
y sandstone, hard, micaceous	3	1	
te clay	17	5	
y sandstone, very hard	16	0	
f limestone, very hard	3	0	
y sandstone, hard	2	3	
te clay	2	3	
rk, hard sandstone, trace of lime.	3	0	
y sandstone, micaceous, hard	2	0	

52.	Slate clay	15	0
53.	Dark limestone, fossil shells	4	0
54.	Dark sandstone	5	0
55.	Slate clay	18	0
56.	Gray sandstone, hard	8	0
		411	11

PARTIAL LIST OF COAL PLANTS

From the Alabama Fields, and Discussion of the Geological Positions of Several Coal Seams.

BY PROF. LEO. LESQUEREUX.

I. List of Species of Coal Plants, represented by the Specimens sent to me by Prof. Eugene A. Smith, State Geologist of Alabama.

1. Sphenopteris Hoeninghausi, Brgt. Helena, Shelby county, Ala. In numerous specimens.
2. Sphenopteris obtusiloba, Brgt. var. Helena, Shelby county, Alabama.
3. Sphenopteris trifoliata, Brgt. Helena, Shelby county, Alabama.
4. Sphenopteris elegans, Brgt. Helena, Shelby county, Alabama.
5. Sphenopteris (Eremopteris) artemisiæfolia, Brgt. Helena, Shelby county, Alabama.
6. Sphenopteris (Eremopteris) flexuosa, sp. nov. Helena, Shelby county, Alabama.
7. Sphenopteris (Eremopteris) crenulata, sp. nov. Helena, Shelby county, Alabama.
8. Sphenopteris (Eremopteris) dissecta, sp. nov. Helena, Shelby county, Alabama.
9. Sphenopteris (Eremopteris) trichomanoides, Brgt. Helena, Shelby county, Alabama.
10. Sphenopteris (Eremopteris) cristata? Brgt. Helena, Shelby county, Alabama.
11. Pecopteris (Aspidites) nervosa, Brgt. Helena, Shelby county, Alabama. Numerous specimens.

12. Sphenopteris amœna, sp. nov. Helena, Shelby county, Alabama.
13. Sphenopteris formosa, Gutb. Helena, Shelby county, Alabama. Same specimen as 14.
14. Sphenopteris Alabamensis, sp. nov. Helena, Shelby county, Alabama. Two large, very fine specimens.
15. Sphenopteris (Adiantites) nervosa, Brgt. Helena, Shelby county, Alabama. Small specimen.
16. Asterophyllites gracilis, Lsqx. Helena, Shelby county, Alabama. Good specimen.
17. Alethopteris Halliana? Lsqx. Helena, Shelby county, Alabama.
18. Lepidodendron squamiferum, sp. nov. Helena, Shelby county, Alabama. One very fine specimen.
19. Ulodendron minus, L. & H. Montevallo, Shelby county, Alabama. Fine Specimen.
20. Sigillaria, undeterminable from varnish. Montevallo, Shelby county, Alabama.
21. Stigmaria ficoides. Montevallo, Shelby county, Alabama.
22. Lepidodendron Weltheimianum, Sternb. Montevallo, Shelby county, Alabama. With leaves, fine.
23. Calamites approximatus, Schloth. Finley's Mine, Tuscaloosa, Alabama.
24. Sphenopteris latifolia, Brgt. Finley's Mine, Tuscaloosa, Alabama.
25. Neuropteris Smithii, sp. nov. Black Creek Vein. Fine species.
26. Calamites Suckowii, Brgt. Warrior Vein.
27. Staphylopteris asterioides? Lsqx. Warrior Vein. Very obscure specimen.
28. Asterophyllites equisetiformis, Brgt. Warrior Vein.
29. Whittleseya elegans, Newby. Specimens formerly sent without marked locality.
30. Cyclopteris? nobilis, sp. nov. One fine specimen, gray shale, without marked locality.
31. Cyclopteris? reniformis, Brgt. One fine specimen, and one poor, without marked locality.

32. Neuropteris subfalcata, sp. nov. Three or four fine specimens, gray shale, marked locality.
34. Neuropteris biformis, sp. nov. One specimen from Alabama; no locality given.
35. Cordaites principalis, Gein. Three specimens from Alabama; no locality given.
36. Asterophyllites equisetiformis? in fruit. One small specimen, from Alabama.
37. Asterophyllites equisetiformis? sterile. One poor specimen; locality doubtful.
38. Asterophyllites foliosus, Gein., sterile. One poor specimen; locality doubtful.
39. Trigonocarpus olivæformis, L. & H. One specimen; locality doubtful.
40. Rhabdocarpus carinatus? Newby. One specimen; locality doubtful.
41. Neuropteris Smithii, Lsqx. From Alabama.
42. Alethopteris Helenæ, sp. nov. Fine species; many good specimens. Helena Vein.
43. Alethopteris Lonchitica, Brgt. Two good specimens. Helena Vein.
43[a]. Lycopodites carifolius, Lsqx. On same specimen as 43.
45. Stigmaria ficoides, Brgt. Six specimens on sandstone; unknown locality.
46. Calamites ramosus, Brgt. One specimen. Alabama; (Helena Vein.)
47. Calamites cistii, Brgt., internal cast of. Locality unknown.
48. Calamites cannæformis, Brgt. Locality unknown.
49. Sternbergia approximata, Brgt. Three specimens, probably from Alabama.
50. Rachis of ferns. Two specimens, probably from Alabama.
51. Calamites approximatus, Brgt. One specimen from Alabama.
52. Calamites cistii, Brgt. One specimen from Alabama.
53. Calamites dubius, with stigmaria ficoides, and undeterminable Sigillaria; locality unknown.

54. Calamites Suckowii, Brgt. Large fine specimens in sandstone. Locality unknown.
55. Undeterminable Sigillaria. Locality unknown.
57. Lepidodendron sexangulare? Goepp. Dev. 1 specimen sandstone. Locality unknown.
59. Lepidodendron Weltheimianum. Sternb. 1 fine specimen gray shale. Alabama.
61 and 67. Branches of Lepidodendron, with leaves. Ala.
62. Lepidodendron and leaves, in sandstone, yellow. Ala.?
65. Lepidodendron leaves, very long. Four specimens, gray shale. Ala.
66. Lepidodendron branches and leaves. One specimen, gray shale. Ala.
68. Sigillaria monostygma. Lsqx. One specimen, gray shale. Alabama.
70. Lepidodendron marginatum. Sternb. One specimen, gray shale. Ala. Rare species.
71. Lepidophloios laricinus, Brgt., or L. obovatus, Lsqx. Gray shale. Ala. Rare species.
72. Calamites Cistii, Brgt. Gray shale. Ala.
73. Sigillaria? decorticated and undeterminable. Large specimen.
74. Rhabdocarpus clavatus? Sternb. Nutlet narrower, may be new; from Ala., mixed with Neuropteris Smithii.
75. Trigonocarpum Parkinsoni, Brgt. Specimen flattened; with Neuropteris subfalcata.
76. Trigonocarpum undeterminable. Same locality as No. 74; has N. Smithii.
77. Trigonocarpum Noeggerathi, Brgt. Gray shale. Same locality as No. 75; has with it Alethopteris Helenæ.
78. Tæniopteris Smithii, sp. nov. *A remarkable species*, of which it would be very desirable to know the locality.

NOTE.—In the above list, the numbers omitted were of specimens from other States.
E. A. S.

TO PROF. EUGENE A. SMITH.

II. Remarks on the Geological Station marked by the specimens sent to me for examination and representing the species above named.

The first specimens sent to me were without labels; and, according to your remarks in your letter, were mostly from Alabama, though mixed with specimens from other States. A second lot of specimens was sent from Helena, Shelby county, Ala. These are numerous and well preserved; therefore of easy determination.

They may give hereafter a point of comparison for fixing the horizons of other beds of coal. In the same lot, I had a few specimen's from Finley's Mine, Tuscaloosa, representing only two species, one of which, *Calamites approximatus*, is present in the whole extent of the Coal Measures, either above or below the Millstone Grit; and from the Warrior Vein a number of specimens, also representing three species only, one, *Staphylopteris asterioides? Lesqx.*, the specimen being too badly preserved for positive determination, and the others, *Calamites Suckowii* and *Asterophyllites equisetiformis*, two species also common in the whole thickness of the Carboniferous formation. Lastly, I received specimens from Montevallo, mostly undeterminable on account of the varnish; but representing at least two characteristic species—a branch of *Lepidodendron Weltheimianum*, and *Ulodendron minus*, not found elsewhere in North America; and in the same box two clay specimens from the Black Creek Vein, representing one species remarkable indeed, *Neuropteris Smithii.*

From this, it is clear that it would be impossible to look for an evidence of relation in regard to the stations of the different beds of coal wherefrom these fossil plants have been obtained, as none of the coal strata, except that of Helena, are sufficiently represented to afford points of comparison by their species. This only we have to acknowledge, that some specimens considered as yet of unknown locality, may be, by their determination, referred to their place of origin. As, for example, No. 41, *Neuropteris Smithii*, to the Black Creek Vein, like *Rhabdocarpus clavatus*, No. 74, which has also leaflets of

the same *Neuropteris;* and No. 75, *Trigonocarpum Parkinsoni*, from the same locality as No. 32, from the presence upon both specimens of the leaves of *Neuropteris subfalcata.* The distribution of fossil plants is not limited in homogeneous or special groups in each bed of coal of different horizons. The species peculiar to a locality, either stratigraphically or geographically considered, are few and always mixed with a number of others which may be called omnipotent, and are found, either in connection with a few beds related by groups, or in the whole thickness of the coal measures. For a determination of comparative stations between two or more beds of coal, it is therefore necessary to have a good series of specimens of each bed; for a comparison of groups, however, the plants of a single bed may afford sufficient evidence.

It is for a general comparison of this kind that we may obtain data, from the specimens of the Alabama coal measures, especially from those of the Helena coal bed.

The first examination of your specimens surprised me by this: that I recognized among them a number of forms which I had not seen elsewhere before, not only species, but peculiar types, differing from those with which I was well acquainted, from my continual explorations during more than thirty years in our North American coal fields. As these first specimens were not labelled, and as I found among them some old acquaintances from Tennessee, I did not dare to draw any conclusions, even supposing that you might have got specimens from Europe in your collection. The examination of the specimens from Helena put the matter in full evidence. For, in the specimens from that locality, we have in the greatest abundance *Sphenopteris Hoeninghausi*, which characterizes the lowest coal measures of England, the Culm of Germany, whose horizon is equivalent to the Sub-carboniferous limestone of the west; the Chester in Illinois; the first and second Archimedes in Arkansas. Of the same age are the species described by Brongniart as *Sphenopteris artemisifolia*, and the new species related to this form, *Eremopteris flexuosa*, *Eremopteris crenulata*, and *Sphenopteris amoena*, which, like the *Ulodendron minus* of Montevallo, have not been found as

yet in the coal measures above the Millstone Grit. Lower than this still, and related to species of the Upper Devonian, is *Adiantites nervosus*, Brgt.; *Asterophyllites gracilis* also, which I have first described from the Sub-conglomerate coal Arkansas, and which, more recently, has been described by Dawson from the Upper Devonian, of Canada, and by Andrew from the Waverly Shale of Ohio. Other species, *Alethopteris Halliana*, *Pecopteris nervosa*, *Sphenopteris trifoliata*, and *S. latifolia*, Brgt., are generally considered species of the low carboniferous of this country. And then we have from Montevallo, *Lepidodendron Weltheimianum* which ranges from the Subconglomerate coal to the middle of the Devonian; and from the Warrior basin, *Neuropteris Smithii*, which finds its analogues in European species described by Gœppert from the Upper Devonian. Now, add to this the number of new species, which, in twenty-six of which the localities are known, amounts to six, or nearly one-fourth, and this will give proof enough that the Coal Measures of Alabama are of a different stage from those of Tennessee, Ohio, Illinois, etc. In my Kentucky Report, I have remarked already upon sub-conglomerate coal measures, represented generally by two thin beds, two feet to four feet thick, distant from twenty to two hundred feet from the base of the Millstone grit. The coal of Arkansas is at the same horizon, and I do not doubt, that if I had been able to find there a larger amount of specimens of fossil plants, many of the species would have been identical with yours—one is, as was said above.

Years ago, I examined at Lebanon, Tenn., the collection of Safford, where I saw many species either identical with, or closely allied to yours, and from the statement of this geologist, his specimens came from under the conglomerate. Therefore, I believe that your coal measures are a branch in connection with that of North Kentucky, but especially with that of Tennessee. In the specimens whose locality is not marked, you have *Whittleseya elegans*, which has never been found before, but in one locality, Cuyahoga Falls, Northern Ohio, in a lower bed of coal, immediately above the Millstone Grit.

Cyclopteris reniformis is also of low coal. Indeed, except the few omnipresent species. Calamites and their branches, Asterophyllites, found everywhere, all your specimens point out characters of species of the lowest carboniferous measures.

All your new species are most interesting, and as my draughtsman has been absent some time, and will begin work again next Monday, I wish to have your specimens about six weeks longer, to enable me to have figures of all that is valuable. You may hereafter want this work for a report, or I may use it in the volume of the U. S. Coal Flora, now in preparation. Among these species, one has surprised me very much; it is the superposition upon the leaves of a species of Lepidodendron, which I have named *L. squamiferum*, of scales, round, square, and thick, though small, placed just at the base of the leaves. They are detached easily, and their characters are easily recognized. Nothing of this kind has ever been seen in Lepidodendron.

I should also remark, that though the specimens are undetermined in regard to locality, the frequency of *Sternbergia* in your carboniferous measures, indicates their old age. These stems are extremely common in the Upper Devonian coal of Canada; but as yet I have never found them in the coal measures of the North. * * * * *

My last observation is about the admirable richness of your coal flora, and the great value of its study to paleontological science. Could you have some of your assistants interested in the collection of specimens, at your different coal veins, I am certain that your State cabinet would become most interesting to study, than any of those which we have as yet in this country.

Very respectfully,

LEO LESQUEREUX.

Columbus, Ohio.

Modified Drift.

The low (Southern) part of Bibb county is covered with a superficial deposit of rolled gravel, sand, clay, &c., which hides entirely the underlying formations. The northern limit of the drift has been touched upon in two or three places in the details of Bibb county; but as the formation has not been made the subject of detailed study, this notice is given at this point merely for the sake of completeness.

Bibb County.

The portion of Bibb county, examined during the past season, is the southern extremity of the Cahaba coal fields, together with the narrow border of Silurian strata lying south and south-east of the coal fields.

The more detailed description of the coal measures, will be found in the article by Mr. T. H. Aldrich.

I propose here to give only a partial account of the Silurian rocks referred to; for the reason that the work which I had planned for the summer, was particularly the examination of the limonite or brown iron ore bearing belt, of this, and the counties lying north-east of it. The time has not been sufficient for a thorough examination of the whole Silurian belt.

The geological formations in this area, so far as they have been identified, are the following:

LOWER SILURIAN.	1. Calciferous or Knox Sandstone.	
	2. Quebec Group,	*a.* shale, (Knox Shale.)
		b. dolomite, (Knox D.)
	3. Chazy.	
	4. Trenton.	
UPPER SILURIAN.	5. Niagara.	
CARBONIFEROUS.	6. Sub-Carboniferous.	
	7. Coal Measures.	
	8. Modified Drift.	

1. Calciferous or Knox Sandstone.

I have noticed this rock only in one locality, viz: On Six Mile creek, in or near Section 36, Township 24, Range 10, east.

The following is a section of the rock there exposed ginning below:

1. Shales, greenish; weathering buff....... 5 feet.
2. Heavy bedded yellowish sandstone......10 "
3. Greenish shales, breaking easily into small fragments.......... .... 4 "
4. Yellowish sandstone.................. 2 "
5. Shaly sandstone...................... 8 inch
6. Blue shaly limestone, with seams of calcite, and showing a twisted or contorted texture.... .... 3 feet.
7. Yellowish shales, alternating with beds of sandstone; thickness not known.

These beds are exposed in the bed of the creek where weathering away and removal of the softer shales, ledg the harder sandstone are left forming a series of na dams. The strike of the rocks here is north-east and th south-east about 45 deg. The creek at this place flows n west, so that the ledges of hard sandstone cross it at angles. Although this formation has not been particu identified elsewhere in Bibb county, there is no reaso doubt that it is to be found lining the north-west edge of belt of shales next to be described.

From the character of the rock—hard sandstones, alte ing with shales—it is found forming sharp ridges, which however, not very high.

In Bibb county, I have not noticed any fossils, or u minerals in this horizon.

2 (*a*). Quebec, or Knox Shale.

Next in order above, and scarcely to be separated from sandstone by any sharp line of demarcation, are the sh The general character of these rocks has been given abo the General Geological Outline.

In Tuomey's Second Report the shales of this age are ferred to on page 79. I give his remarks in full: "F Pratt's Ferry, a series of grayish red slates may be tr across the country to the Coosa. This forms the substra

of a very remarkable soil, which differs materially from the soil of the clay slates of the primary rocks. The slates are inter-stratified with beds of limestone, the disintegration of which must have produced a decided effect upon the soils of this region."

The most southerly exposure of these shales noticed by me, was about five or six miles from Centerville, on the Montevallo road. From this place they trend in a north-eastern direction, and are seen again near the Shelby county line in S. 21, T. 24, R. 11, E., a mile or two west of the house of Col. J. Newton Smith. At this place the reddish brown and buff-colored shales alternate with limestones, sometimes shaly, and sometimes tolerably pure. Beyond this, into Shelby Co., the same belt may be traced, and at Montevallo it is seen in its best development.

The disintegration of the shale gives a clayey soil which is quite productive, but liable to suffer from dry weather. The interpolated beds of limestone add to the strength of the soil.

Of useful minerals, I have noticed none in Bibb county at this horizon, though in other counties small beds of limonite or brown iron ore are located here.

The limestones, especially the purer varieties, have been used in the manufacture of lime.

2 (*b*). Quebec, or Knox Dolomite.

From an economical point of view, this is by far the most important of the formations under consideration in Bibb Co., for it holds the banks of limonite or brown iron ore from which the blast furnace at Brierfield, and the bloomaries or Catalan forges of the past have been supplied.

This is the most extensive limestone formation, not only of this county, but probably also of the State.

The characteristic rock is a gray or whitish dolomite or magnesian carbonate of lime. In some places the dolomite is quite crystalline and pure, but oftener it is impregnated with siliceous matter. Occasionally it contains a sandy impurity which, upon the weathering away of the rock, becomes

quite prominent. The siliceous matter, however, is foun
the dolomite usually in concretionary masses, and the c
as it is called, forms the angular flinty gravel which cover
ridges of this formation. Owing to the prevalence of silic
matter in the rock, it forms ridges rather than valleys,
the chert which covers the hillside is quite character
The presence of minute rhombohedral cavities in the c
(from the removal by decomposition of small rhombohe
crystals of dolomite,) is a common character by which it
be distinguished from the chert of other formations.
character was first pointed out by Prof. James M. Saffo
Tennessee. The concretionary character of most of the c
has also been shown by Prof. F. H. Bradley, to be a di
guishing mark.

Other varieties of limestone, dark blue, argillaceous,
occur occasionally in this formation, but the great mass
is made up of the cherty dolomite above described. In
county it is found, in the localities examined, in two b
The first belt lies adjacent to the lower part of the Ca
coal fields, from which it is separated by a fault. The se
belt is found some 2 to 4 miles southeast of the first, with s
of the chazy, calciferous sandstone, and Quebec shales i
vening.

Useful Materials, &c.

LIMESTONE.—Some of the purer strata have been use
lime burning, but usually the amount of siliceous matt
the dolomite renders it unfit for lime burning as well a
fluxing, an unfortunate circumstance, since the great ma
the limonites of this State, and northward, occurs in this
ticular formation.

IRON ORES.—In the areas covered by the Quebec or
Dolomite, are found the most important banks of limoni
brown iron ore. The general considerations concerning
ore will be found above in the General Outline. I shall
give only the particulars of its occurrence, so far as I hav
amined it, in Bibb county.

Of the limonites found in the first belt of Dolomite
tioned above, the banks in S. 13, T. 24, R. 10, E., lie nea
to the coal fields. These banks are the property of the

by Iron Company. As stated before, they are adjacent to the coal measures, and it is extremely difficult to determine exactly where the line of demarcation between the two formations lies. Near the most westerly of these banks, a capping of ferruginous sandstone, and sometimes of a ferruginous conglomerate, exactly similar in appearance to the ferruginous sandstones which are so characteristic of many of the hills of the Drift, is found covering the summit of hills of Carboniferous sandstone. Here, though the hills are mainly the sandstone, there is a superficial covering of pebbles and ferruginous rock, which I am inclined to believe is of much later date. At any rate, on one of the hills which has this capping of a ferruginous sandstone or conglomerate, too siliceous to be of value as an ore of iron, an improvement in the quality of the ore may easily be noticed as one descends the hill, and about half-way down it has been regularly worked. At this point, the surface ore has frequently grains of sand, and in some cases quartz pebbles enclosed in it; but by excavating a few feet, very excellent qualities of limonite, fibrous, ocheous, and compact, (liver ore) are brought to light. This locality, for convenience, may be called No. 1. The old Brighthope bloomary on the Little Cahaba, a few miles distant, was supplied in part with ore from this bank.

The analysis of an *average sample*, selected by myself from this bank, is given below. Mr. J. Blodgett Britton of Philadelphia is the analyst.

Bank No. 1. Limonite. Average Sample.

Sesquioxide of Iron	79.93	=56.10 Metalic Iron
Insoluble siliceous matter, (white sand)	6.04	
Water	10.49	
Sulphur	None.	
Phosphoric Acid	1.01	= 0.45 Phosphorus.
Alumina	1.43	
Lime	.07	
Magnesia	trace.	
Oxide of Manganese	.92	
Undetermined matter, and loss	.11	
Total	100.00	

An analysis of the compact, liver brown variety, from t place, gave me the following composition in 100 parts:

Compact brown iron ore, breaking with smooth conchoi fracture; color of ore, liver brown; of streak, yellow brown; quite brittle. Locality, Bank No. 1, Bibb county.

Combined Water	7.41	
Siliceous matter	3.06	
Ferric Oxide	82.84	=57.91 Metallic I
Alumina	0.35	
Oxide Manganese	0.95	
Lime	1.02	
Magnesia	0.19	
Phosphoric Acid	0.55	= 0.24 Phosphor
Sulphur	0.45	
Loss	3.18	
Total	100.00	

100 Iron contains 0.41 Phosphorus.

The Brighthope Bloomary above referred to was also par supplied with ore from several other pits close to No. 1.

One of these pits, No. 2, is in the valley at the foot of hill on which No. 1 is located. The ore here presents same varieties as that from No. 1, and an *average sample* c lected by me, and analyzed by Mr. Britton, shows the follo ing composition in 100 parts:

Bank No. 2. Limonite. Average Sample.

Pure metallic iron	51.96	
Oxygen with the iron	21.14	
Water	12.44	
Insoluble siliceous matter (white sand)	7.84	
Sulphur	None.	
Phosphoric acid	1.35	–0.58 Phosphor
Alumina	1.47	
Lime	.11	
Magnesia	.12	
Oxide of manganese	3.36	
Oxide of cobalt	Trace	
Undetermined matter and loss	.21	
Total	100.00	

A large mass of ore, showing some six to eight feet cube above ground, is exposed in place at one of the pits. How much below the ground this mass extends, is not known.

Higher up, on the side of another hill, are other banks from which ore has likewise been abstracted for the bloomary. An *average sample* of the several varieties found here, No. 3, and analyzed by Mr. Britton, gives the following composition in 100 parts:

Bank No. 3. Limonite. Average Sample.

Pure metallic iron	55.05	
Oxygen with the iron	23.58	
Water	12.72	
Insoluble siliceous matter (white sand)	5.61	
Sulphur	None.	
Phosphoric acid	1.30	–.57 Phosphorus.
Alumina	1.36	
Lime	.06	
Magnesia	.10	
Oxide of manganese	.11	
Undetermined matter and loss	.11	
Total	100.00	

The area here over which the ore is exposed, is about three-fourths of a mile square, and the quantity of the ore which these banks may afford in the future, is doubtless very great. The proximity of the banks to seams of workable coal of good quality (about 1½ miles distant in a straight line) must also be noticed.

The rugged nature of the hills, however, will probably make the work of transporting the coal an item of some expense. In Mr. Aldrich's report, the seam known as the *Gholson Vein*, is the nearest to the ore banks. Upon this, an opening was made and worked during the war, in section 10, township 24, range 10, east.

The seam is said to be six to seven feet in thickness, but the opening was filled with water at the time of my visit, so

that I cannot give the thickness except from report. Many tons of the coal have been lying exposed for eleven years, yet the lumps are coherent, and burn well now. It is said to be a non-coking coal.

A short distance from the ore banks just described, in a ridge composed of chert of the Quebec or Knox Dolomite, is a deposit of pipe ore, the extent of which is, as yet, not known, since only the outcroppings of it have been examined. This ore differs materially from those mentioned above. It occurs in stalactitic, botryoidal masses; outer surface brown, giving cherry red powder; mass of the ore reddish brown, affording a dark red powder.

My analysis of this ore shows the following composition in 100 parts:

Pipe Ore, from Ashby Iron Company's Land, Bibb Co., Ala.

Specific gravity	3.78	
Combined water	8.54	
Siliceous matter	2.34	
Ferric oxide	87.49	61.27 Metallic iron.
Alumina	0.27	
Oxide manganese	0.12	
Lime	0.82	
Magnesia	0.33	
Phosphoric acid	Trace.	
Sulphur	0.48	
	100.39	

If found in sufficient quantities this ore will one day be valuable.

In the immediate neighborhood of these banks are several sites on the banks of a small stream, well suited for the erection of a blast furnace. As yet, none of the limestone of the formation holding the ore, has been found fit for use as a flux; but a short distance, half a mile at furthest, from the banks, the belt of chazy limestone, next to be described, holds some beds of very pure limestone. So, also, some of the calcareous

layers of the Quebec Shale, have afforded very good limestones for this purpose.

About one and a half miles south-east of these ore banks, on the eastern edge of the same Dolomite belt, section 19, township 24, range 11, east, is the Owen Bank, also the property of the Ashley Iron Company. The ore here is limonite, and it covers a considerable area. As yet, no explorations of the ore have been made, and the quality of the ore is known only from surface specimens. Most of the pieces are hollow, the cavities being filled usually with yellow ochre, though sometimes with a yellow sand.

Concerning the ores (except the Pipe Ore,) from the above-named localities, and also from Dr. Starr's, (see below), Mr. Britton, who has kindly made the analyses for the survey, writes: "The minerals appear to belong to the same class precisely, and for iron making are unquestionably most valuable. They contain too much phosphorus for "Bessemer" metal, but not so for ordinary foundry iron and commercial bar and rails."

It is usually stated that a pig iron fit for use in making Bessemer steel, must contain not more than 0.10 per cent. of phosphorus in the ore. Now, ores of this degree of purity, as regards phosphorus, are comparatively rare, only three or four localities in Alabama affording them.

It is, therefore, with pleasure that I give the following extract from the pages of a recent number of the Engineering and Mining Journal, written by Prof. R. W. Raymond, U. S. Commissioner of Mining Statistics:

"PHOSPHOROUS STEEL. THE MOTAY PATENTS.

"In May, 1874, letters patent of the United States were granted for the manufacture of Phosphorus Steel, to EDWARD STERN of New York, as assignee of the entire right of C. M. T. DUMOTAY, the inventor, who resides in Paris, France. This new manufacture, which substitutes phosphorus for carbon, as the agent for steelifying iron, will enable steel-makers to substitute the cheap and abundant phosphoric irons of the country for the comparatively rare and costly non-phosphoric

irons, which heretofore have been deemed the only material from which good steel could be made.

Like all patented inventions which advance any important art, a step forward, Mr. STERN's right to his patent for this invention has been contested by other claimants, which is somewhat remarkable, considering the vigorous investigation into the history of the art, by the scientific corps of the Patent Office, which, it is well known, is always made before a patent is granted. But interferences were declared between those who filed the conflicting claims and Mr. DU MOTAY, and in every case, priority of invention has been awarded to him. The last of these cases was decided on the 8th day of the present month (Dec. 1875).

"This important patent having thus successfully run the guantlet of conflicting claimants, its trial, or probationary period, may fairly be considered to have terminated; and it may now be regarded as having entered upon the term of established and conceded validity, which all patents for new and important inventions attain, sooner or later, and those who have taken licenses under it, may rest with confidence upon their title, and safely proceed to construct their plant, which, fortunately, is inexpensive, as compared with that for making the Bessemer or crucible steels, and, therefore, is adapted for use by the small iron works with limited capital, as well as by larger and wealthier establishments."

It is impossible as yet to foresee the extent of the revolution likely to be caused by the introduction of this process, in the manufacture of steel in this country.

Adjoining the Owen tract, mentioned a few paragraphs above, on the land of Mr. Wallace, is also a very considerable show of surface specimens of limonite, of the same character with those last described.

Both these localities are immediately adjacent to the belt of chazy limestone which will afford good material for fluxing.

Of other limonite banks, in this western belt of Dolomite, I may mention the following:

In S. 26, T. 24, R. 10, E., on Mr. Hansberger's land, the limonite is dark bluish, probably from manganese. Many spe-

cimens are botryoidal and covered with a black glaze; others columnar, with radiating fibrous texture. Near this place, the worn pebbles of the drift cover the hill tops, and many fragments of ferruginous sandstone, apparently also belonging to the drift, may be noticed. On the land of Dr. Starr, same section and about half a mile distant, is a large exposure of limonite, fibrous, and compact varieties. The rounded pebbles, ferruginous sandstone, and ferruginous conglomerate (pebbles cemented togother by brown iron ore) of the drift, cover the ground here; and the ferruginous sandstone, like that of the drift, is one extreme of a series of ferruginous rocks, of which pure, fibrous, and compact limonite, with little or no admixture of sand grains, is the other. If the pebbles, conglomerate, ferruginous sandstone, and limonites do not belong to the same period, it is difficult to draw any line between the ferruginous sandstones on the one hand, and the iron ores on the other. It will be remembered that the same transition was noticed above, at one of the banks of the Ashby Iron Company.

An analysis by Mr. Britton of a sample of the ore from Dr. Starr's, shows the following composition in 100 parts:

Limonite from Dr. Starr's. Average Sample.

Pure Metallic Iron	50.07
Oxygen with the Iron	21.08
Water	10.49
Insoluble siliceous matter, (white sand)	14.11
Sulphur	None.
Phosphoric Acid	.80 = .35 Phosphorus.
Alumina	2.65
Lime	.11
Magnesia	.07
Oxide of Manganese	.41
Undetermined matter, and loss	.21
Total	100.00

In S. 34, T. 24, R. 10, E., on Mr. Cottingham's land, is also an occurrence of limonite showing the same varieties as that

at Dr. Starr's. These two banks are probably identical, as they lie adjacent to each other. They are both contiguous to the chazy belt, and hence, in reach of good limestone.

At Mr. Joe Lightsey's, two miles north of Blake's Ferry, on the Cahaba, I am informed, there is another limonite bank. So, also, below Pratt's Ferry, at Mr. Williamson Jones'. These two localities I have not yet visited; but get my information from Col. J. Newton Smith.

Still further south-west there is a good deal of limonite on Mr. Rottenberry's land, but this belongs, I believe, to the sub-carboniferous formation.

Upon the eastern Dolomite belt, are several extensive deposits of iron ore, the best known of which are the Brierfield banks in S. 22, T. 24, R. 11, E., that on Col. J. Newton Smith's land in same section, and that on Mr. J. Allen's land, section 21, same township and range. The quality of the ore from these banks is well known, for the Brierfield furnace has gotten its supplies from them. Of the extent of these deposits I can say very little, having never gone carefully over them; yet the superficial distribution of the ore over nearly two land sections would argue a very considerable quantity.

South-west of this deposit, on Mrs. Carter's land, in S. 31, T. 24, R. 11, E., on Six Mile creek, is another deposit which I have never visited; but derive my information concerning it from Col. Smith.

Any one familiar with the Dolomite belts of Bibb, Shelby, Talladega, Calhoun, and Cherokee counties, will appreciate the difficulty of giving all the localities where limonite is found. Only the more extensive beds can be enumerated, and even of these, there will probably be found in the sequel many omissions. I hope, however, to fill up these omissions at some future time.

All the beds of ordinary limonite described above, occur in clay usually red or yellowish-red, with sometimes white streaks. The ore lies without any apparent regularity, in larger or smaller lumps in the clay. The concretionary origin of the limonite is apparent on most of the fragments. I shall not at this place discuss the mode of origin, or geologi-

cal age of these ores, further than to mention one fact, which has come under my observation: Near Col. Smith's I found a specimen of limonite, a pseudomorph after pyrite, with good crystals, and such specimens are not altogether uncommon.

The Iron Industry in Bibb County.

So far as I know, the manufacture of iron from its ores in Bibb county, prior to 1862, was by means of the Catalan Forge. Of these, may be mentioned, Smith's or Brighthope Bloomary, Camp's, and perhaps one or two others.

In 1862, the Brierfield Blast Furnace was started with C. C. Huckaby, President, and J. Newton Smith, Superintendent; other members of the company were G. Huckaby, Greene S. Wilson, and J. D. Nance. Under this management it continued until 1864, when it was sold to the Confederate States Government. At the close of the war it was confiscated by the United States, and sold by that Government, in 1866, to Frank S. Lyon, of Demopolis. Under the superintendence of Gen. J. Gorgas, the furnace was run by Mr. Lyon for two years, and then leased to T. S. Alviss & Co., under whom it continued until the autumn of 1874, when operations were suspended.

A rolling mill was also worked during the war, and perhaps before that time, at Brierfield; but I have not been able to collect any information concerning it or its management.

OTHER MINERALS.—*1. Barite*, or heavy spar, is of frequent occurrence in the Quebec Dolomite. Maguire's Shoal on the Little Cahaba, and the "Sinks" on Six Mile creek, may be mentioned as localities, but barite is found in veins, in many other places.

2. *Calcite and Dolomite* are often found crystalized in veins in the rocks of this formation.

3. *Quartz.*—As was stated above, the dolomite of this formation is characterized by the presence of a very considerable mixture of siliceous matter. Besides the concretionary chert so universally found in it, cavities and fissures are frequently lined with quartz crystals.

Springs.—Throughout the area covered by the Quebec

Dolomite, large, freely-flowing springs are abundant. One of the finest noticed in Bibb county is at the residence of Col. J. Newton Smith. From this spring flows a large body of water, sufficient to make a considerable creek. The so-called "lime sinks," are also characteristic of this formation.

Six Mile creek, in section 26, township 24, range 10, east, flows under a bluff of compact gray and blue limestone or dolomite, and comes to the light again after an underground passage of about a quarter of a mile. Funnel shaped depressions of the ground are also frequent throughout this area, marking the spots where subterranean caverns have been formed, into which the superincumbent earth has fallen. These features are not, of course, confined to the Quebec Dolomite, but they occur in other limestone formations, notably in this State, the sub-carboniferous.

3. Chazy.

The equivalents of this sub-division, are the *Chazy* strata of the New York Reports, (whence the name,) and the "*Maclurea*" *Limestone* of Prof. Safford, of Tennessee.

Localities.—A belt of this limestone lies between the western Dolomite belt and the Calciferous or Knox Sandstone. It is also found at Pratt's Ferry on the Cahaba. That there are many other occurrences of it in Bibb county, other than those specially to be described below, there can be little doubt.

Kinds of Rock.—The most characteristic rock is a blue limestone, often argillaceous, containing locally, immense numbers of the peculiar fossil *Maclurea Magna.* Other strata of the limestone are thin-bedded and flaggy, breaking up easily into regular blocks, with smooth faces. Frequently, beds are encountered which are made up almost exclusively of the fragments of crinoidal stems, with frequent impressions of *orthocerata* sometimes as much as eighteen inches long, and the shells of small brachipods. This limestone, though so full of fossils, will not always yield them to the hammer, and a fresh fracture generally exposes only the crystalline

faces of the limestone. Upon weathered surfaces, however, the fossils are frequently brought into relief.

A compact blue limestone, almost pure, with no traces of fossils, has from its position, been referred to this sub-division, though it may belong to the next higher group. The argillaceous, and flaggy limestones, are very often fetid and bituminous.

A section of the rocks of this period may be seen in passing from Pratt's Ferry, south-east, towards Mr. Cottingham's and beyond. I am unable to give the thickness of the several strata, which are exposed to the extent of about one mile, going across the strike.

Beginning at the ferry, we find the following section in ascending order:

1. Blue compact limestone, with Maclurea magna; the rock is full of the impressions of these shells; but owing to its compactness they cannot be gotten out. According to the angle made between the shell and the weathered surface of the limestone, the shape of the impression varies. When the upper flat surface of the shell and the surface of the limestone coincide, the spiral whorls of the shell are brought out very plainly. When, however, the shell lies at an angle to the weathered surface, oval, crescent shaped, and semi-circular figures are brought out.

2. A crystalline limestone, full of impressions of orthocerata, sometimes eighteen inches long. The mass of the limestone appears to be made up of fragments of crinoidal stems and small brachiopod shells. These show only upon the weathered surfaces of the limestone. A fractured surface of the stone shows only crystalline facets.

3. Grayish shales, or calcareous shales.

4. Smooth-faced, shaly limestone, breaking up easily into regular rhomboidal blocks.

5. Grayish limestone in valley. (Hills covered with drift pebbles.)

6. Smooth, slaty, or shaly limestone nearly vertical, having a very strong bituminous smell. The latter rock is exposed very well in and near the road by Mr. Cottingham's, in

section 34, township 24, range 10, east, whilst the ferry is in section 33, of same township.

The areas underlaid by the shaly, flaggy, block limestone, are covered with a growth of red cedar.

In section 35 or 36, same township, the dark gray bituminous limestone is noticed again, with shaly, smooth-breaking layers. Between this and the exposure of calciferous sandstone on Six Mile creek, (described a few pages above,) the limestone is found only in the depressions, the hill tops and sides being covered with pebbles. Across Six Mile creek, in section 25, township 24, range 10, east, the same flaggy limestone may be traced, and in section 19, township 24, range 11, east, there is a very extensive outcrop of *Maclurea-bearing* beds. Incredible numbers of these fossils are here found, portions of the limestone being almost entirely made up of them. At this locality they are very easily separated from the rock, and specimens six and seven inches in diameter, are not uncommon. The interior of the shells is frequently crystallized calcite. In the limestone of this formation, especially the more massive varieties, a peculiarity in the weathering is noticeable. Where large, solid rounded masses project above the ground, the weathered surfaces are often marked with ridges and furrows radiating from a central elevated point, "as if the fingers had been drawn over it when soft." These ridges show as Prof. Tuomey suggests, that the structure of the rock is not homogenous, and, in the denudation, the harder, more siliceous streaks have been left in relief by the wearing away of the softer portions. I have noticed this peculiar appearance oftener upon the limestone of this period than upon any other, though, of course, similar conditions would cause it to show upon limestone of any age.

Useful Rocks and Minerals.—Many of the limestone layers are pure enough for making lime; some of them are almost pure carbonate of lime.

In two or three of the localities mentioned above, very good flags can be obtained, as the rock splits up very smoothly and evenly.

Many of the outcrops would furnish good building material.

Of minerals, *calcite* is that which has been most frequently noticed in veins, and filling cavities in the chazy limestone.

4. Trenton.

About three miles north of Centerville, in S. 11, T. 23. R. 9, E., a bed of limestone is found, sparry, buff-colored, and made up of fossil remains of brachiopods, orthocerata, &c., and which belongs to this group. The fossils are easily detached, beautifully preserved, and this locality is therefore one of great interest. This bed I have seen at one point only, though there is little reason to doubt that it may be traced some distance towards the north-east.

I am indebted to the kindness of Prof. A. H. Worthen, State Geologist of Illinois, for the determination of the geological position of this limestone.

5. Niagara.

In section 11, mentioned in the preceding paragraph, an occurrence of the fossiliferous red hematite of the Clinton subdivision of the Niagara group was noticed, in close proximity to the Trenton limestone abone described. The fact that the belt of red ore of the Red Mountain group of Prof. Tuomey showed outcroppings in Bibb county, has been known for some years, and this is the most southern point where I have seen it. Of its occurrence further north-east in the county, I know nothing as yet from personal observation. The ore is found on land belonging to Mr. McIlvain of Centerville.

6. Sub-Carboniferous.

This formation in Tennessee has been subdivided into the *Siliceous Group* below, and the *Mountain Limestone* above it. This division is here retained.

Wherever I have seen it in Middle Alabama, this formation is represented principally in the Siliceous group, though several occurrences of shaly limestone, with fossils of the upper group, will be noticed further on, in Shelby county.

In Bibb county, I have as yet to record only rocks of the lower or *Siliceous group*, and these only in one locality.

Five or six miles north-east of Centreville, in S. 6, T. 23, R. 10, E., a ridge of chert may be traced for some distance. The sides of this ridge are covered with angular fragments of chert, full of the impressions of crinoidal buttons, and of brachiopods. On the flauks of the ridge are also seen many masses of limonite, some of which give promise of being good ore, whilst the greater part appears to be too much contaminated with cherty matter to be of much value. This seems to be the case with most of the limonite found in connection with the *Siliceous sub-group*. The chert is sometimes quite hard and compact; but again, it has decomposed into a white powder, filling cavities in the limonite. This siliceous powder is easily distinguished from " chalk," (the name usually given to it,) by its sharp, gritty feel, when rubbed between the fingers.

7. Coal Measures.

Mr. Aldrich's paper will give all the information available concerning the Cahaba fields, so that any details of the occurrence of coal seams in Bibb are unnecessary.

8. Modified Drift.

It has already, in several places above, been intimated that the pebbles, sands, conglomerates, &c., of the Modified Drift are occasionally found covering the hill-tops of some of the Silurian areas described. As we go south and south-east, the Silurian and other formations are soon lost under a deep covering of the Modified Drift, which has not, as yet, been particularly studied.

Shelby County.

General Outline of the Geology of Shelby County.

A general idea of the geological relations of this county can, perhaps, best be given by taking the two coal fields, the Cahaba and the Coosa, as the starting points.

The Cahaba river, above Helena, marks very nearly the eastern limit of the Cahaba coal fields. Below Helena, this limit lies, in general, eastward of the river, as may be seen by consulting a geological map of the State. Crossing Kelly's creek, the line between Shelby and St. Clair, a narrow strip of coal measures, the Coosa coal field is found occupying an area about 6–8 miles wide between the Cahaba and the Coosa rivers. This strip runs, in the northern part of Shelby, nearly south-west, but lower down it turns nearly south, and the sandstones and shales of the formation are found as far south as the line of the S., R. & D. R. R. Between the Cahaba and the Coosa coal fields, as thus described, we find the rocks of the Silurian, Devonian, and Sub-carboniferous formations distributed in the manner given in the details below. It is proper, however, to state here, that the eastern and south-eastern limits of the Cahaba fields are marked by a fault or break in the strata, by which the Calciferous Sandstone and Quebec or Knox Shales are brought up to the level of the coal measures. The *amount* of the displacement thus caused, can be given only after accurate and numerous measurements of the thicknesses of the several strata shall have been made.

This fault has been accurately traced by Mr. Squire from the lower end of the Cahaba fields, as far north-east as Helena; beyond that my own observations have not extended, nor have I the information which can enable me to speak confidently on this point.

East of the Coosa fields, there is another fault by which the Quebec Dolomite is brought up to the level of the coal measures. This, in general, is the geological outline. The detailed examinations have as yet been made only over a small part of the county.

GEOLOGICAL FORMATIONS.

The geological formations, as yet identified in Shelby county, are, beginning with the lowest, the following:

Lower Silurian.	1. Calciferous or Knox Sandstone.
	2*a*. Quebec or Knox Shale.
	2*b*. Quebec or Knox Dolomite.
	3. Chazy, and Trenton.

Devonian......	4.	Black Shale.
Carboniferous.	5.	Sub-carboniferous.
	6.	Coal Measures.

1. Calciferous Sandstone, and 2. Quebec Shale.

The general characters of this rock have already been given, and it is necessary only to give the occurrences in Shelby county, so far as noticed. At Helena, the yellowish and reddish sandstones, with their accompanying shales, are seen in immediate juxtaposition with the sandstone of the coal measures. The best exposure of this proximity of the two formations is seen just east or south-east of the rail road bridge. Above the bridge, at the dam, ledges of this sandstone cross the creek, where they are brought out finely by the weathering away of the interpolated shales. Opposite the office of the Central Iron Works, a spring comes up from beneath a limestone stratum, which probably belongs near the limit between the sandstone and shale.

A marked difference in the dip of the rocks of the coal measures and the Calciferous, may be noticed at this place; for the latter stand almost vertical, with a slight dip, however, towards the south-east, whilst the former dip south-east at an angle of 45 deg. or less.

Going southward from Helena towards Montevallo, the road lies, in general, near the limit of the coal measures. At Mr. Dunnam's, S. 22, T. 20, R. 3, W., the Calciferous Sandstone is seen, nearly vertical, and with a strike almost north and south; and two or three miles south-west, in sections 32 and 33, T. 20, R. 3, W., are the same rocks, showing a strike (perhaps local) of north 20 deg. west. From Helena this place, the variegated sandstones and shales are the prevailing rocks. About six and a half miles north of Montevallo, they are encountered again, and within three miles of that town, the road lies entirely over these rocks. In the immediate vicinity of Montevallo the Knox formation has its best development; but since the Calciferous or Knox Sandstone, and the Quebec or Knox Shale overlying it, are closely associated, and since the two are, in the absence of fossils, scarcely to be sharply sep-

arated, I have thought it best to describe them together. Prof. SAFFORD, in his Geology of Tennessee, makes a threefold division of his Knox Group, viz:

1. Knox Sandstone.
2. Knox Shale.
3. Knox Dolomite.

The three make in Alabama, as well as in Tennessee, a very well marked natural group --the Sandstone passing gradually into the Shales, by becoming thin bedded and shaly, and at last true shales,—the shales passing up into the Dolomite through the interposition of layers of shaly limestone.

Upon paleontological grounds, the Sandstone has been separated from the Shale; but in the absence of fossils, this separation is very difficult, as there is no well marked line of distinction between them lithologically. It may turn out, if fossils should be discovered, that what I have called the Calciferous Sandstone, is only a part of the Shales, with ledges of sandstone interpolated. Still, since the Calciferous of this report is the exact representative (in color and character of the rock,) of the typical Knox Sandstone, west of Knoxville, I shall refer the variegated thick bedded sandstones, with thin beds of shale, provisionally at least, to this geological horizon. I may here state, however, that I have not noticed fucoidal impressions in any of the sandstones in Shelby, whilst in Talladega, and Calhoun counties, where these rocks occur, these impressions are very characteristic, as they are, also, near Knoxville, Tenn.

In passing from Mr. Aldrich's coal mine, a few miles west of Montevallo, eastward towards the latter town, after leaving the coal measures we go at once into the Calciferous, as is the case at Helena. Crossing a belt of this we come upon the variegated shales of the overlying Quebec formation, and these continue to Montevallo. Near that town, and west of the former residence of Hon. B. B. Lewis, the shales have beds of impure limestone interpolated. These beds have been traced by me about two miles north-east of Montevallo, in section 15, township 22, range 3, west, near the house of Mr. Perry. Here the strata are almost entirely blue lime-

stone, with thin argillaceous bands. The weathering of this rock brings into relief the argillaceous seams, and the limestone appears very distinctly banded. Associated with this banded limestone is a very peculiar conglomerate, composed of small rounded masses of limonite, made up of concentric layers, and held together by a yellowish-white calcareous cement.

The strata of this limestone, from one mile north-east of Montevallo up to this place, strike nearly north-east and dip at high angles south-east. At Mr. Perry's the dip is nearly vertical, and a branch running over the upturned edges of the rock, brings out its peculiar structure very clearly.

This blue limestone, with thin argillaceous seams, lies near the top of the Quebec Shale, and the transition from it into the blue layers in the lower part of the Quebec Dolomite, is very gradual, and may be best noticed in Montevallo, just below (west of) the Female Academy. Down the slope of the little hill, about fifty feet thick of a blue limestone, which is probably the base of the Dolomite, outcrops in successive ledges, forming a very gradual transition to the blue argillaceous limestone which we have just mentioned. Having no fossils by which these rocks can be certainly identified, their exact position is of course, in part a matter of conjecture, still I feel tolerably confident, that the line between the Quebec Shale and the Dolomite, may be found near the point indicated.

Returning now to Mr. Perry's in section 15, and going northward, we cross from the blue banded limestone, into a valley of red, buff colored and yellow shales, which are very characteristic. These shales are found first alternating with thin layers of limestone, which gradually disappear, and there succeeds a belt of the shales, with their peculiar agreeable colors. The valleys formed by these shales are much valued farming areas.

Continuing our course northward, we encounter thin seams of yellowish and reddish sandstones, interbedded with the shales. These sandstones become more numerous as we proceed, and at the mill in section 10, township 22, range 3, west,

they are the prevailing rocks, with subordinate layers, however, of buff, and chocolate colored shales. These, in disintegrating under the influence of the weather, break up into small pointed pieces, which resemble wooden shoe-pegs. How much further north-east this belt oι shales and sandstones continues I have not yet the means of knowing, but I think it probable that it turns northward very soon, if it does not die out altogether, for between the mill in section 10, township 22, range 3, west, and Longview on the South & North Ala. R. R., there is a belt of Dolomite succeeded by the Chazy limestone.

South and south-west of Montevallo, the belt may be traced for several miles, and a very fine exposure of the strata can be seen near the residence of the late Mr. Paul Lewis, where a cut in the branch road running out to the coal mines, lies near the bank of the creek.

On the road from Centreville to Montevallo, about two miles north of where it crosses Mahan's creek, the line between Bibb and Shelby, outcroppings of these shales and sandstones are seen, and these continue to within a mile of Montevallo, where the Dolomite is entered.

3. Quebec or Knox Dolomite.

As this formation is very well exposed in the immediate vicinity of Montevallo, I shall take its occurrence there as a starting point in the description.

In speaking of the Quebec Shale, it was stated above, that the upper blue limestone layers of that formation, pass with gradual transition into the blue limestone observed in the western edge of the town of Montevallo. This limestone, I take to be the lower part of the Dolomite in this place; about fifty feet of it outcrops at the place indicated. Coming into the town, the deep red color of the soil cannot fail to attract attention. This deep red color is characteristic of a belt of land lying between the shales and the first ridge of chert about a mile east of Montevallo; it is due to the iron held by the Dolomite.

Near the bridge over Shoal creek, are bluffs formed by

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strata of the Dolomite, and a fine spring issues from beneath the bluff. Some of the Dolomite layers here are banded with thin seams of silicious matter, which become very prominent upon the weathering away of the rock. These projecting lumps and bands of chert, give to the dolomite a very rough and uneven surface.

At this point the strike appears to be nearly north and south, with a dip of five to ten degrees east. This slight dip may be noticed also in the lower strata of the formation, the blue limestone layers, in the western edge of the town, and the passage from these slightly inclined strata, to the nearly vertical beds of the underlying shales, a mile distant or less, is noteworthy.

Going from Montevallo eastward, near the crossing of the creek, another fine spring may be seen issuing from beneath the light gray dolomite of this formation. Continuing eastward, the road crosses near the town a considerable ridge, formed of the chert, so characteristic of the Dolomite, and especially of its upper part. To this ridge succeeds a valley, and then another chert ridge, beyond which we come into the valley underlaid by Chazy limestone. The western edge of this limestone valley is about three miles from Montevallo.

Lying east of the belt of sandstone and shales, already described, and between it and the limestone valley of the succeeding formation, the Dolomite has been observed from Montevallo as far north as Helena, from which place it continues, without doubt, north-eastward towards the Georgia line.

A special enumeration of details concerning its occurrence in the area indicated is not necessary, and I shall confine myself to an account of the

Useful Rocks and Minerals.

First in importance are the iron ores. *Limonite*, or the brown iron ore, is the only one of the iron ores of the formation of any economical value. It would be impossible to enumerate all the localities where it is found. As yet, but few of the ore banks in this part of the county have been worked, there

being only one furnace in the county, though the Brierfield furnace in Bibb, has drawn upon Shelby for a part of its ore.

In the lower edge of the county, soon after crossing the creek which forms the southern boundary, limonite of good quality may be observed everywhere along the road for the distance of a mile or two. Again, in the southern edge of the town of Montevallo, close by the rail road depot, is the bank from which ore was shipped by Mr. Ware to the Bibb furnace. The iron made from it is said to have been of the best quality, and indeed some of the best and toughest iron made in the State has been turned out from the Brierfield furnace. This Montevallo bank, or part of it at least, is the property of Mr. Wells of that town.

Northeast of Montevallo, near Longview, in S. 19, or 20, or 21, T. 21, R. 2, W., is a bank which promises well, but which has not yet been thoroughly explored, unless by private enterprise.

This iron land has, I believe, recently become the property of the Shelby Iron Company.

I give below two analyses by myself, of ores from this place.

No. 1. Radiately fibrous, limonite; outer surface smooth, mammelonated, with reddish color; interior rough, more or less porous and ochreous. Shelby County, six or eight miles northeast of Montevallo.

Specific gravity	4.31	
Combined water	11.19	
Siliceous matter	3.09	
Ferric Oxide	84.10	58.89 Metallic Iron
Alumina	0.27	
Oxide Manganese	trace.	
Lime	1.02	
Magnesia	0.08	
Phosphoric Acid	0.20 =	0.09 Phosphorus.
Sulphur	0.46	
Total	100.00	

100 Iron contain 0.15 Phosphorus.

No. 2. Compact limonite, breaking with smooth conchoidal fracture; moderately brittle; color of ore, light liver-brown; of powder, yellow. Shelby county, six or eight miles north-east of Montevallo.

Specific gravity..................	3.61	
Combined water................	11.27	
Siliceous matter................	13.49	
Ferric Oxide...................	73.44	=51.43 Metallic Iron
Alumina......................	1.03	
Oxide Manganese..............	0.00	
Lime.........................	0.38	
Magnesia	0.08	
Phosphoric Acid..............	0.33	= 0.14 Phosphorus.
Sulphur......................	0.28	
Total..................	100.30	

100 Iron contain 0.27 Phosphorus.

A specimen of limonite from this Dolomite belt, from Shelby county, five miles north-east of Helena, gave me the following composition in 100 parts:

Combined water................	11.98	
Siliceous matter...............	1.50	
Ferric Oxide...................	84.03	=58.82 Metallic Iron
Alumina......................	0.20	
Oxide Manganese..............	0.20	
Lime.........................	0.24	
Magnesia	trace.	
Phosphoric Acid..............	1.22	= 0.49 Phosphorus.
Sulphur......................	.03	
Total..................	99.40	

100 parts Iron contain 0.83 Phosphorus.

West of Siluria on the S. & N. Road, are several occurrences of limonite, of which, however, I have no analyses.

Again, south or south-east of Columbiana, at the Shelby Iron Works, we find one of the most extensive limonite deposits that has been yet explored. The works are in S. 13,

T. 22, R. 1, W., and the ore banks are found within an area of a mile or two about the works.

Of the quality of this ore, analyses given below, and in Prof. Tuomey's report, as well as the well known quality of the iron made from it, are sufficient indications.

Through the kindness and liberality of Mr. Walter Crafts, Supt. of the iron works, I am enabled to give the following analyses of ore made by Prof. C. F. Chandler:

Analysis of ore from the banks of the Shelby Iron Company.

Combined water	9.25	
Siliceous matter	7.06	
Ferric Oxide	78.86	=55.20 Metallic Iron
Alumina	2.37	
Oxide Manganese	1.49	
Lime	0.58	
Magnesia	trace.	
Phosphoric Acid	0.37	= 0.16 Phosphorus.
Sulphur	0.14	
Total	100.12	

100 Iron contain 0.29 Phosphorus.

Roasted Ore from banks of Shelby Iron Co.

Combined water	3.80	
Siliceous matter	11.74	
Ferric Oxide	81.35	=56.19 Metallic Iron.
Alumina	1.59	
Oxide Manganese	0.75	
Lime	0.57	
Magnesia	0.12	
Phosphoric Acid	0.11	= 0.05 Phosphorus.
Sulphur	0.16	
Total	100.09	

100 Iron contain 0.09 Phosphorus.

East of the Coosa coal fields the Dolomite of the Quebec Group is again found, and it makes the country eastward to the Coosa river and beyond, into Talladega county. In many places from Cropwell down to Harpersville, and below to Wilsonville, this dolomite, with its characteristic chert, shows the presence of iron by the deep red color of the soil, and in very many places the limonite is found in quantity sufficient to form ore banks.

Notwithstanding this great superficial distribution of ore, the Shelby Furnace is the only one in the county. There is little doubt that there is ore enough to supply many blast furnaces.

Of other useful minerals found in connection with the dolomite, I may mention that at Kelly's creek a very pure specimen of *pyrolusite* or *black oxide of manganese* has been found. Of the extent of this occurrence, and its relations to the associated rocks, I can say very little.

The chert so characteristic of this formation, has been occasionally, in other States, manufactured into mill-stones, for which some of it is admirably suited, and it might be well if our people would take this fact into consideration.

As in Bibb county, so here, some of the pure limestone strata of the formation are used for lime burning, and in the blast furnaces as a flux.

Iron Industry in Shelby County.

There are two blast furnaces in the county, both the property of the Shelby Iron Company. The works are located about five miles south of Columbiana, with which town there is communication by a branch rail road from the S., R. & D. road.

A blast furnace has been in operation here about thirty years. Furnace No. 1 is 12 feet across the bosh, and 56 feet high. The average yield per day: First blast, 13 tons; second blast, 18 tons; third blast, 14 tons, of 2,268 pounds. The two first blasts were on hot blast Pig Iron, and the last on car wheel Pig Iron.

This furnace blew out December 15, 1874, having made a run of three years, nine months and fifteen days.

Furnace No. 2 went in blast Jan. 6, 1875, and has made an average yield thus far (Feb. 2, 1875,) of 13 tons per day. Furnace is 60 feet high and 14 feet across the bosh.

The blowing cylinder of Engine No. 1 is 66 inches, and 4½ feet stroke; of Engine No. 2, blowing cylinder 84 inches, and 4 feet stroke.

The waste gases are used for heating the boilers.

The ore is limonite, or brown hematite; and fuel, charcoal.

Localities of the ore banks and limestone have already been given above, and need not be repeated here.

Central Iron Works.

R. W. Cobb, President; R. Fell, Jr., Secretary; Postoffice, Helena, Shelby county.

This is the only rolling mill in the State; one at Brierfield, in Bibb county, was destroyed during the war, and has never been rebuilt.

This establishment has four puddling furnaces complete, and one heating furnace; three engines, one of them, which drives the mill, 120 horse power; one muck mill complete; one guide and hook mill; and the shears, squeezer, and punches necessary for the operations of the mill.

The manufacture of the Alabama Loop Cotton Tie is made a specialty.

With the new machinery put in, the production will be about 1,000 tons per annum.

4. Chazy and Trenton Limestone.

Lying east of the Quebec Dolomite, which is found near the eastern border of the Cahaba coal fields, we find a belt of this limestone of variable width.

Part of the rock is impure and shaly, but much of it is nearly pure carbonate of lime, as can be seen from the analyses given below.

Wherever the limestone occurs, the characteristic fossil,

Maclurea magna, can generally be seen upon the weathered surfaces of the rock.

The upper part of the belt seems generally to be occupied by a compact bluish gray limestone in which few if any traces of fossils are to be found. This may belong to the lower part of the Trenton, the Black river limestone; but the collections of fossils thus far made are too meagre to render a distinction possible.

In going southward from Helena, after crossing a belt of Dolomite, one comes into a blue limestone area, and the little ridges radiating from a central elevated point can be seen on most of the outcropping masses of the limestone. This limestone here, as in Bibb county, seems to be at the base of the chazy, or perhaps it may belong to the top of the underlying Dolomite. At any rate, a narrow belt of it is found between the Dolomite and the blue limestone with *maclurea.* The road which lies over the lower blue limestone, is one of the worst imaginable, for the rocks all lie near the surface, and above it, and a clear wagon way is impossible without the expenditure of some well directed labor; and, as is well known, in our State such labor is never put upon the public roads. These bald rocky places are covered with a growth of red cedar.

The road from Helena follows this limestone, as far south as Siluria station. Besides the easily recognized *maclurea,* the limestone shows great numbers of other fossils, which are, however, difficult to identify, since they appear only as prominences upon weathered surfaces, and it is impossible to detach them from the rock. No doubt a diligent search would be rewarded by the discovery of some fossiliferous strata from which the shells might be extracted.

At Siluria a wide flat valley is underlaid by this limestone, and the edges of the strata can be seen over the plain, like low walls. The western boundary of the valley here is a ridge of chert of the underlying Quebec Dolomite, and near the foot of it issue bold limestone springs. A fine pond spring was seen upon the land of Dr. Tichenor.

Near the station, and also upon the land of Dr. Tichenor,

a ridge is noticed upon which are some outcrops of an impure argillaceous limestone, which has been burned and tested as to its fitness for a cement rock. The tests made by Mr. Figh, of Montgomery, and Mr. Reynolds, of Prattville, show conclusively that this limonite, properly prepared, will make a first-rate hydraulic cement.

Other localities in Bibb and Talladega counties, where rock occurs suitable for this purpose were visited, but no practical tests have been made of it. There is very little doubt, however, that there is a sufficient quantity of cement rock in the State, but our people seem, as yet, to have given very little attention to this subject.

South of Siluria the Chazy limestone extends in an unbroken area to Longview, in section 19, township 21, range 2, west. Here the Dolomite comes eastward near to the rail road, and the Chazy occupies a belt of about three miles in width, east and west. The eastern limit of it is made by a ridge of sub-carboniferous chert, full of crinoidal buttons.

Below Longview, I have seen very little of this formation, except as far South as the line of the Selma, Rome & Dalton Road, and I cannot give a better idea of its location in this part, than by a section of the strata crossed in going from Montevallo to Calera. The line of this section lies very near the base line of the Huntsville survey.

After leaving the chert ridges, east of Montevallo, which have already been mentioned in connection with the Dolomite, the section passes into a low valley with water-worn outcrops of blue limestone, with the usual "ridgey" surfaces. As well as could be made out, this limestone strikes nearly north and south and dips east. This place is about three miles east of Montevallo, and near Dr. Hale's lime-kiln, which this rock supplies with material. At the crossing of the dirt road and the rail road the limestone is succeeded by a mass of black shales or slates, overlaid by a heavy bed of chert, full of impressions of brachiopod shells and the joined stems of crinoids.

This chert belongs undoubtedly to the Siliceous Group of the Sub-carboniferous. The shales *may be* the so-called

Black Shale of Devonian Age, though I have no means of determining absolutely, this point.

Continuing westward, the ridge of crinoidal chert is succeeded by a belt of black shales, and then by limestone again, probably Chazy; and this alternation of Cherty ridges, with blue limestone, continues as far as Calera. At that place the Chazy limestone prevails. About one mile east of Calera, near Mr. Dare's lime-kiln is a ridge of Crinoidal Chert, with impressions of brachiopod shells, striking nearly north and south, or perhaps a litttle east of north. A blue limestone may be seen at the foot of the western slope of this ridge. From this, the kiln is supplied. I discovered no fossils in the rock, but from its general appearance, and close resemblance to specimens of the Chazy limestone, I have little doubt that it belongs to that horizon.

Near Mr. Thompson's house, just north of Calera, is a quarry in dark blue argillaceous limestone, which is fossiliferous, though I was unable to get a single specimen which could be identified. This limestone is immediately overlaid by a mass of black slates, splitting like roofing slates, but more fragile. About ten feet of these slates are exposed above the limestone. At this particular point the rocks strike nearly east and west, and dip five to ten degrees north. The slates lie under a mass of chert which forms a small ridge. The chert is like that near Dare's kiln, full of impressions of brachiopod shells, and of crinoid stems.

The explanation of the above facts, which seems to me most probable, is that between Montevallo and Calera, the Chazy, and perhaps the Lower Trenton limestone, is bent up into several waves; in the troughs of these waves are the remnants of the Black Shale and Sub-carboniferous Chert, which at one time probably covered also the crests of these folds, but which have been removed by denudation. I put this forth as a conjecture, although my observations of the dip have not been numerous enough to enable me to assert that the strata lie in folds. It may be on the other hand, that a succession of faults has brought about this repetition of the Chazy and overlying beds. I regret that the only

time I have been able to give to this locality has been whilst crossing it hurriedly on my return after the conclusion of the season's field work.

If any of the Upper Trenton, or Cincinnati beds are associated with the above-mentioned Chazy outcrops, they have not yet been identified.

Besides this area, there is a limestone, east of the Shelby Iron Works, which furnishes the flux for the furnace, which from its position between the Dolomite on the west, and Subcarboniferous strata on the east, may possibly belong to this formation. The analyses of different beds of this rock given below, show, when compared with analyses of the Chazy from other localities, great similarity in the composition; though, perhaps, very little significance should be attached to this, since pure limestones may belong to any geological horizon.

Economic Materials, Minerals, &c.

This formation furnishes in this part of the State most of the limestone used in the manufacture of lime.

Calera has long been known for the excellence of the lime manufactured there. At present there are two kilns at that place under the superintendence of Mr. N. B. Dare. The rock is supplied from the formation under consideration.

North of Calera are other kilns supplied from the same source. At Longview, section 19, township 21, range 2, west, is the kiln of Mr. James M. Reynolds.

I give below two analyses by myself, of the limestone used by him.

No. 1. Compact drab-colored limestone, showing occasional crystalline faces; breaking with splintery fracture.

Specific gravity	2.81
Carbonate of lime	99.11
Carbonate of Magnesia	0.75
Iron and Alumnia	0.13
Siliceous matter	0.39
Total	100.38

No. 2. Very fine grained to compact. From same locality.

Specific gravity	2.75
Carbonate of Lime	99.16
Carbonate of Magnesia	0.75
Iron and Alumina	slight trace.
Siliceous matter	0.15
Total	100.06

Both specimens were tested for sulphur and phosphorus, and neither was detected.

The limestone analyzed above, is from the upper part of the belt, and is probably one of the limestones of the lowest Trenton, (Bird's eye or Black river.) Upon this point, however, the evidence of fossils is too scanty, as yet, to enable me to speak with certainty.

All the limestones used for lime-burning at Siluria, Calera, &c., are practically the same in composition as the above. There are of course, slight local variations, but from a number of analyses from various sources, the carbonate of lime is between 95 and 99 per cent.

The following analysis by Prof. C. F. Chandler, has been kindly furnished by Mr. Crafts:

Limestone from Mr. Jones', Section 28, Township 21, Range 2, west, on S. & N. Rail Road near Longview.

Carbonate of Lime	97.52
Carbonate of Magnesia	1.27
Iron and Alumina	0.35
Silica	0.78
Phosphorus	Trace.
Sulphur	0.00
Total	99.92

Near Siluria station are the Rockland Lime-Works of Maj. Wagner. The kiln is in section 35, township 20, range 3,

west. It is built upon Page's patent; the limestone is raised to the top of the kiln by means of an elevator, run by steam power.

The Siluria Lime Works, Messrs. Holt & Co., are in section 2, township 21, range 3, west, about a mile from the station. The limestone is the same as that used by the Rockland Kiln.

A specimen of the limestone from the quarry of the Shelby Iron Company, has been analyzed for the survey by Prof. Stubbs, with the following results:

Carbonate of lime	96.70
Iron and alumina	1.40
Insoluble matter	2.50
	100.60

I append also some analyses by Mr. J. B. Britton of the limestone from the quarry east of the Shelby Iron Works, in section 15, township 22, range 1, east. I am indebted to the liberality of Mr. Crafts, superintendent of the iron works, for the analyses.

Limestone from the Quarry of the Shelby Iron Company.

	No. 1	No. 2.
Carbonate of lime	93.77	98.91
Carbonate of magnesia	2.48	0.58
Iron and alumina	1.01	0.63
Siliceous matter	2.09	1.08
Phosphoric acid	0.00	0.00
Iron pyrites	0.29–0.16 sulphur.	0.10
Water	0.23	0.00
Total	99.87	101.30

No. 3. Seam from same quarry, light colored, granula

Carbonate of lime	67.55
Carbonate of magnesia	24.91
Iron and alumina	3.58
Siliceous matter	3.46
Sulphur	0.02
Phosphorus	0.03
Water, and loss	0.45
Total	100.00

No. 4. Dark colored, compact seam, from same quarr

Carbonate of lime	95.40
Carbonate of magnesia	0.94
Iron and alumina	0.68
Insoluble matter	2.25
Sulphur	Trace.
Phosphorus	Trace.
Water, and loss	0.73
Total	100.00

Of other minerals there is not much to record. Just s of Calera, and associated with beds of limestone of group, is a small bed of limonite exposed in the dry cha of a little branch. The limonite has very intimately m with it, in varying proportions, *barite* or *heavy spar.* S portions of the bed showed almost pure limonite, o limonite and barite in equal proportions, and still ot almost pure barite. Scarcely a hand specimen could be tained without both minerals.

Barite in veins constantly accompanies the belt of C limestone described above.

4. Black Shale, Devonian.

Of the occurrence in Shelby county of this stratum, the representative, in Alabama, of the Devonian system, I can not feel absolutely certain, yet I have reason to believe that the black shale, which is found immediately underlying the Crinoidal Chert of the Sub-carboniferous formation, between Montevallo and Calera, and beyond that, belongs to this period. I have, as yet, found no fossils in any of it, but in its general characters it agrees with the description of the Black Shale in Tennessee. Characteristic is the occurrence almost universally in it, of spherical or flattened masses of iron pyrites. Scarcely an outcrop of the shale has been seen in which these balls of pyrites have not been found. It is probable that the Shelby Springs, (sulphur,) come from this shale. In other parts of the State, sulphur springs arising from it are common enough.

Near Mr. Thompson's at Calera, there is in the bed of a branch a black bituminous shale which will burn, and it is found underlying a ridge of Crinoidal Chert, of Sub-carboniferous age. From Mr. Dare and Mr. Thompson, I learn that the same shale is found in the vicinity of Calera, in a similar position at many other points.

The section of strata between Montevallo and Calera, given a few pages above, may also give some information upon this point.

5. Sub-Carboniferous.

In speaking of the Chazy limestone, most of the occurrences of this formation, in Shelby county, within the area examined, have already been given.

The formation is represented usually by its lowest member, the *Siliceous*, and the principal rock is a porous chert filled with the impressions of shells, and crinoids. The dissolving away of the calcareous parts of the shells, &c., gives to this chert its porous character.

The chert usually forms ridges which have their normal position on the eastern limit of the areas of Chazy limestone. Such is the case from Siluria to Calera, where I have exam-

ined it, and it is probable that in a similar relation to the Chazy it will be found further northward.

Characteristic ridges of this chert are, the one just mentioned; that lying east of Mr. Dare's lime-kiln; one near Mr. Thompson's house at Calera; and finally the succession of low ridges, dividing strips of Chazy limestone between Calera and Montevallo.

East of the Shelby Iron Works there is another representative of the formation, in a shaly blue limestone which weathers into a dark brownish shale. This limestone is full of fossils, some of which are in a beautiful state of preservation. Chief amongst these are the delicate, lace-like traces of bryozoans. A species of Productus is common, as are also the fragments of the stems of crinoids. One crinoid head found, proves to be a pentremite. Cyathophylloid corals also are not rare.

The locality is in S. 11, T. 24, R. 15, east, near the house of Mr. John T. Wilson.

Specimens from this locality were submitted to Prof. A. H. Worthen, State Geologist of Illinois, who considers them as belonging to the equivalent of the Chester Limestone of the Illinois Geological Reports. This would bring them into the Mountain Limestone Group, of our subdivision, and the occurrence of strata both of the Siliceous and Mountain Limestone Groups of the Sub-carboniferous thus far south in Shelby, is as interesting as it was unexpcted.

Of useful materials in this formation, might, perhaps, be mentioned the chert, which often approaches in character buhr-stone.

On very few of the cherty ridges enumerated above are accumulations of iron ore—the brown ore wanting. So far as my observation goes, however, it contains too much silica, though frequently specimens of very fine limonite occur.

6. Coal Measures.

Mr. Aldrich's paper will give all the information within our reach, concerning the Cahaba coal fields. Of the Coosa fields no detailed examination has, as yet, been made, but notice of

them and also of the Warrior fields will be found in the paper referred to.

Between the ridge of sub-carboniferous chert at Dare's Lime Kiln near Calera, and the belt of Knox Dolomite east of Columbiana, there is a great series of sandstones and shales, with one or two strips of limestone. I have not as yet been able to determine with certainty the age of these rocks, having found no fossils in them; but I have little doubt that the sandstones and shales belong to the coal measures of the Coosa field which extend southward as far as the line of the S. R. & D. rail road, and probably to the Metamorphic area below that.

In this opinion I am strengthened by the fact that strips of sub-carboniferous chert are found in several alternations with Chazy or Black River Limestone, between Montevallo and Calera; and north of Calera, the sub-carboniferous cherty ridges have been traced as far as Siluria Station. East of that point, some two or three miles, I am informed by Dr. I. T. Tichenor, President of the Agricultural and Mechanical College, that a bed of coal has been found. This could scarcely belong to the Cahaba fields, and it is Dr. Tichenor's opinion, also, that it belongs to the Coosa fields. Within the area of sandstones and shales which I have mentioned, are found one or two, and perhaps more, strips of limestone, which are believed by Prof. A. H. Worthen to be of the age of the Chester Limestone of southern Illinois (sub-carboniferous), although no fossils were found in it, sufficiently well exposed to allow of an absolute determination. With this same limestone, or near it, is also found a moderately thick stratum of black carbonaceous shale, with lenticular concretions of iron pyrites, which *may be* the Black Shale of Devonian Age. In the vicinity of Shelby Springs, which is in the midst of this sandstone and shale region, are found also beds of limestone, and the sulphur water may be derived from the shale. These, however, are mere conjectures, since without recognizable

fossils the determinations of the ages of the rocks can not well be made with certainty. South-east of Columbiana, about four or five miles from the Shelby Iron Works, is another belt of shaly limestones with easily recognizable fossils, belonging to the sub-carboniferous group (Chester Limestone), according to Prof. Worthen's determination; (see, also, above.)

I have thus given the reasons for the belief that the shales and sandstones, which make up so large a part of the central region of Shelby county, are those of the coal measures of the Coosa fields.

It may be noticed also, that further north-east, near the Coosa Valley road, just south of Kelly's creek, and also below Harpersville, the same sandstones and shales are observed, and on the way from Harpersville to Columbiana the country is a barren piney woods from near the former town to the valley of Four Mile creek, which is Knox Dolomite. Siliceous sandstones, with occasional faces drusy with quartz crystals, and yellowish argillaceous shales, make up this barren country.

At Morgan's Mill a good exposure of the sandstones is found, and upon fragments of these rocks just below the dam, I found a black carbonaceous shaly material filling in fissures in the sandstone, and covering some of the faces of it, a thickness of half an inch and more. This shaly substance looks very much like coal, but has only a small percentage of carbon. It burns white before the blow-pipe, but does not decrease materially in bulk.

Out towards the north-west from Harpersville and Kelly's creek, is the rough, rugged country which is laid down on Prof. Tuomey's map as the southern portion of the Coosa coal fields. I can not, therefore, resist the conclusion, from my observations, that these measures extend still further south to the limit given above. I know, however, of no *coal* found further south than the locality mentioned near Siluria.

Near Columbiana, north-east, is a prominent ridge called, locally, the "Mountain;" but as my observations about Co-

lumbia have been too limited to enable me to give with certainty the geological equivalents of the strata, I shall only give here a section of the rocks composing the Mountain, reserving a further description of this whole region to some future time.

The Mountain has the shape of a horse-shoe, with the two free ends pointing north-east. Around the north-western arm of the horse-shoe flows Beeswax creek, which cuts the south-eastern arm in two at Leeper's Mill, S. 21, T. 21, R. 1, east.

In going over the Mountain from Columbiana, we cross a series of gray and buff shales with limestone at the foot of the ridge; higher up the Mountain, shaly sandstones passing into a fine grained conglomerate, with quartz grains of the size of a wheat kernel to that of a pea. (This conglomerate is exactly like specimens obtained from the Potsdam sandstone ridges in Talladega county.) The conglomerate forms the crest of the Mountain, and is succeeded on the other slope of the hill by highly ferruginous shaly sandstones, several strata of which become a tolerably fair ore of iron, as may be seen from the appended analysis. This ore is a *red hematite*, compact, and laminated, breaking into rhomboidal fragments, by reason of a series of joints. Minute clear crystals of quartz are imbedded in the ore, which are of vitreous lustre on the fresh fracture, but become white and opaque after exposure.

The ore does not seem to be confined to any one single stratum, but the shaly rock occurring with it has more or less of iron in its composition, so that in places it becomes an ore.

Succeeding these rocks, is a second bed of conglomerate similar to the first, and after it shales and shaly sandstones to the bottom of the hill. Where crossed, the strata have the strike of the ridge, N. 10 deg. W. and dip N. 80 deg. E.

On the south-east arm of the horse-shoe the Mountain is cut by Beeswax creek, and Leeper's Mill is just below one of the ledges of conglomerate. The same shaly ferruginous sandstones passing into an ore of iron, are here observed also. The strike is east north-east, and dip at an angle of 75 deg. or

more to the north north-west. Here also limestone is seen dipping under the sandstones at the foot of the ridge, whether conformably, or not, I am unable to say.

The geological equivalents of these rocks have not yet been satisfactorily made out, and I shall leave that part of the subject to a future occasion, remarking only that the conglomerate, to which the ridge owes its height and prominence, is precisely like some specimens from the Potsdam sandstone further north.

Through the courtesy of Mr. Walter Crafts of the Shelby Iron Works, I am enabled to present the following analyses:

Limestone from Quarry on S., R. & D. R. R., near Columbiana, by Dr. C. F. Chandler.

Carbonate of Lime	89.03	
Carbonate of Magnesia	3.91	
Iron and Alumina	1.08	
Iron Pyrites	0.26	—0.136 Sulphur.
Phosphoric Acid	0.00	
Silica	4.88	
Water	0.64	
Total	99.80	

This is the limestone mentioned as dipping under the sandstones of the Mountain. Analyses of the same rock from Beeswax creek are found in Prof. Tuomey's Report.

Two analyses of the red hematite ore from the mountain, No. 1, by Mr. J. B. Britton, and No. 2, by Dr. Chandler, are also given:

No. 1.

Metallic iron	44.61
Silica, &c	29.06
Sulphur	0.00
Phosphorus	0.30
Alumina	3.66
Manganese	1.00

100 parts Iron contain 0.67 Phosphorus.

No. 2.

Ferric oxide.................	70.09	49.08 Metallic iron.
Silica....................	23.45	
Sulphur....................	0.11	
Phosphoric acid.............	0.77	0.34 Phosphorus.
Alumina, lime, magnesia, &c...	5.58	
Total..............	100.00	

100 parts Iron contain 0.69 Phosphorus.

The analyses are made from ores from two different localities, and the close agreement in composition is very noticeable.

Near Calera, on the banks of Buxahatchee creek, are found bluffs of black slate which were noticed by Prof. Tuomey years ago. Other localities in the vicinity of Buxahatchee show similar outcrops of these slates, which have been examined in several places as to their fitness for roofing slates. As yet, I know of no quarrying done in them, and I am unable to give their geological position, having spent only a short time in the neighborhood.

Between Shelby Springs and Columbiana, slates are well exposed in Camp Branch and on Waxahatchee, and the examination of these localities as well as those on Buxahatchee, will doubtless be of much interest.

TALLADEGA COUNTY.

Topography.

Talladega county lies between the high range of hills called the Blue Mountain, Rebecca Mountain, &c., on the east, and the Coosa river on the west. The water courses, with the exception of Talladega creek, have their sources on the western flank of the prominent quartzite ridge called Blue Mountain, and flow westward into the Coosa. Talladega creek, on the other hand, takes its rise in the Metamorphic hills, cuts its way through the highest of these, and through the slates and conglomerates of the Acadian group, and flows thence south-westward into the river.

The principal range of hills in the county is the Blue Mountain on the eastern border. Next, in point of height, are the hills of Potsdam sandstone. West of the S., R. & D. Rail Road, from Alpine station to Choccolocco creek, may be seen one of the most prominent of these ranges. At Alpine the height of one of the summits is 2,000 feet above the rail road level, or 2,495 feet above the sea level. North-east of Talladega the peak called Mt. Parnassus is one of the most prominent of these in that vicinity.

In the south-western corner of the county, is a broken country called the Kahatchee Hills, which are, in part at least, Potsdam sandstone. A prominent peak amongst these lies immediately behind the residence of Mr. Albert Crumpler. It is 800 feet above the rail road level at Childersburg.

Of secondary importance are the numerous cherty ridges of the Knox Dolomite. Some of these are isolated knobs, and have the name mountain attached to them. One of these, west of Alpine, is Calhoun Mountain, about 375 feet above the level of the Coosa at that point.

General Geological Outline.

The geological formations found in Talladega county, are—

Lower Silurian.	1. Acadian—Conglomerates and slates, semi-metamorphic.	
	2. Potsdam—Sandstone.	
	3. Calciferous—Sandstone, or Knox-Sandstone.	
	4. Quebec,	(*a*) Shale, or Knox Shale.
		(*b*) Dolomite, or Knox Dolomite.
Devonian.	5. Black Shale.	

By far the greater part of the county is covered by the strata of the Quebec Dolomite, which stretches, with the few interruptions to be described below, from the Coosa river eastward to the semi-metamorphic slates and conglomerates of the Acadian Group.

Near the centre of this area, or about half way between the Coosa and the Acadian Hills, rises a range of hills, or more properly mountains, of Potsdam Sandstone, which has, along its eastern flank, a fringe of varying width of Quebec Shales chiefly, though the Sandstone is not wanting in places.

In the southwest, the Kahatchee Hills, also Potsdam Sandstone, make a very rugged country. Patches of the Dolomite, and also of the Quebec Shales, are caught in amongst these hills, and in some instances, half metamorphosed.

Lastly, the Black Shale is found on the western flanks of the Potsdam Sandstone of the Kahatchee Hills in one or two localities, in the extreme southern and western portions of the county.

Details.

1. Acadian Slates and Conglomerate.

The western border of the Metamorphic rocks in Alabama, is formed by a belt of slates and conglomerates, semi-metamorphic in aspect, and varying width, but perhaps of an average width of six miles. These rocks which, in every respect seem to be the exact equivalents of Prof. Safford's Ocoee Slates and Conglomerates, are referred like them to the Acadian Epoch.

In my report for 1874, these rocks have been descr
somewhat at length, and I shall give here only a detailed
tion of them along Talladega creek, from Dr. Taylor's
in section 13, township 19, range 5, east, as far up the c
as the Upper Falls, in or near section 27, townshi
range 6, east, a direct distance *across the strike* of about
or six miles, although following the meanderings of the c
the distance is much greater.

At Dr. Taylor's mill, the creek flows through a na
gorge over one hundred feet deep, cut into greenish ta
or hydro-mica slates, emerging into the Silurian Valle
that place. The eastern part of the valley is occupied
narrow belt of crystalline marble, blue and white, w
from its position and the associated minerals, I have
hesitation in pronouncing metamorphosed Knox Dolo
(see below.) About a mile up the creek from the mill,
more compact strata of talcoid slates form a barrier,
which the waters of the creek fall in several beautiful
cades, ten feet and more in height. The long conti
action of the waters has worn the rock into numerous
holes, in which flourish many varieties of water plants,
numerous fresh water gasteropods. As far as up as Rid
mill, in section 16, township 19, range 6, east, the same s
prevail, and the creek flowing in general *across the stri*
often deflected from its normal northwest course, and
along the line of strike. Wherever the creek has been
turned aside, the slates are more compact and tougher,
present high bluffs, upon which, in the crevices of the
a scanty growth of *red cedar* is always found. In
places, where the creek flows along the strike, the rocks
pear to be much softer, though showing, in general, the
characteristics as the harder portions. In these places,
the creek has always a narrow bottom on each side, and
precipitous bluffs are wanting. In the south-west quart
south-west quarter of section 17, township 19, range 6,
is the crushing mill of Senator A. Cunningham, and the
mine is in section 20, adjoining. The auriferous quartz
of varying thickness, lies in a partially decomposed sla

the nature of those spoken of above. (See also below.) The width of the belt of tolerably uniform slates, (greenish, talcoid or hydro-mica slates,) between Taylor's and Riddle's mills, is about four miles.

The numerous shoals and falls formed where the creek cuts through the harder strata of the slates, furnish water power in abundance. It has been utilized at three or four points only as yet, viz., Taylor's, Cunningham's, and Riddle's Mills, and at the site of the old Maria Catalan Forge, in S. 17, T. 19, R. 6, east. This forge, like others of its kind, has been abandoned since the introduction of blast furnaces.

Above Riddle's Mill, the smooth, greenish slates become more and more siliceous, and pass soon into a conglomerate, which, with many alternations with softer yellowish, buff colored, and greenish talcoid slates, makes up the country as far as the upper falls of the creek.

The conglomerate, which is sometimes a slaty, arenaceous rock, but oftener quite massive, is made up of the lumps or pebbles of *opalescent* quartz, and opaque white fellspar, held in a matrix of greenish talcoid matter. Where the greenish matrix prevails, the weathered masses of the conglomerate show a beautiful dark bluish green color. Other weathered masses of this conglomerate are lighter and more yellowish in color.

Characteristic are the bluish, milky white *opalescent* quartz pebbles or grains.

All the bluffs and shoals of the creek above Riddle's Mill, to the Upper Falls, are caused by these heavy beds of conglomerate. Frequently large blocks of the rock have been loosened from their places above by weathering, and have rolled down the steep hill-sides into the edge of the water, and, in some instances, far into the bed of the creek, causing the waters to make a detour. It is upon these immense blocks of conglomerate, (often larger than the ordinary log-cabins of the country,) that the pleasing bluish green color is best seen. Upon a fresh fracture it is not so evident. In several places the creek flows through narrow gorges in the conglomerate, where the rocky banks of the stream rise abruptly, almost

precipitously, at least two hundred feet above the water level.

It needs scarcely to be mentioned that the shoals thus formed afford an almost unlimited water power.

The old Eagle Forge and the Rob Roy Forge were located upon this creek, the former in the south-east part and the latter in the northern part of S. 21, T. 19, R. 6, E.

The rugged nature of the hills which lie between this magnificent water power and the outside world, will stand in the way of its utilization for some time to come. It should be noted, however, that the construction of a roadway along the banks of the creek, whilst necessitating the expenditure of a large amount of money and labor, would undoubtedly be a long stride towards bringing to light the mineral treasures of the Metamorphic regions beyond; for it would open an easy highway far up in the heart of this region.

That this is feasible, the excellent roads lately constructed along the Ocoee, and similar streams in Tennessee, are a sufficient proof.

Above the site of the Eagle Forge, a belt of soft green talcoid or hydro-mica slates is found, similar to those below Riddle's Mill.

The Upper Falls are formed by a heavy-bedded quartzite which forms the crest of the highest ridges in this part of the Metamorphic region. The Blue Mountain and Rebecca Mountain are formed in great part by it.

The quartzite is principally, at this place at least, a dark bluish almost massive rock, with some mica, and perhaps feldspar. Subordinated, are lighter colored beds, and also a very coarse conglomerate, frequently ferruginous. Towards the eastern flank of the ridge, I have always found a thin-bedded, fine grained siliceous slate, which breaks up into small pieces resembling chips of wood. The siliceous slate varies in color from a dark slaty gray, to almost white.

The "Great Falls" are located upon the maps at this place, where the creek cuts through the quartzite. They are, however, beautiful shoals, but hardly true falls, as the highest of them are not more than three or four feet. The lowest falls,

just above Taylor's Mill, are much more deserving of the name—falls.

Since the writing of my last report, I have reason to believe that the quartzite just spoken of is a metamorphosed Potsdam Sandstone. This point, however, will probably soon find its solution at the hands of Prof. Frank H. Bradley, to whom belongs the credit of having done more than any other man towards settling the disputed question of the age of the Metamorphic rocks of the Southern Apalachians.

As one point of resemblance between the quartzite and the non-metamorphosed Potsdam Sandstone, may be mentioned the abundance of fine chalybeate springs, found in so many localities upon the flanks of each. (See Report of 1874, pp. 42 and 65, and also below, under Potsdam Sandstone.)

Along the banks of Talladega creek, above Riddle's Mill, the bluffs and shoals, with few exceptions, are formed of conglomerate; it is not to be inferred, however, that softer slates are entirely wanting. Along the road from Ashland to Talladega, a few miles south of the line of the creek, the slates are seen to be almost, if not quite, as abundant as the beds of conglomerate.

Below Riddle's Mill I believe the conglomerate plays a very subordinate part; heavy beds of greenish, soapy-feeling, smooth slates prevailing almost exclusively.

Lastly, I may state that the rocks just considered have, almost without exception, a strike of north-east and south-west, and a dip of 45 deg. or so, towards the south-east. I have never yet noticed any occurrence of the reverse dip (to north-west) in this belt of slates, &c., either at this place, or elsewhere, where I have crossed it.

Of Useful Minerals, in this formation in Talladega county, I have only to record *gold*, which has been profitably worked at the Riddle Gold Mine, (now the property of Senator Cunningham.) Much of the quartz here mined shows the gold plainly to the eye, and the numerous assays of samples from various depths, as well as the testimony of those who have worked the mine, show that the mining can be carried on with profit.

It is plain, however, that with the rude machinery used much of the gold is lost in working up.

Gold has been mined also north-east and south-west of this place, in the same belt, but with no other appliances than the pick and pan.

2. Potsdam Sandstone.

Of the sandstone of this age in Talladega county, there are two distinct occurrences; the one in the northern, and the other in the southern part of the county. The former, being more simple in its details, will be first described.

Two or three miles north of Alpine Station, on the S., R. & D. R. R., a range of mountains extending from near Choccolocco creek above Talladega, ends with three high and prominent peaks. From these peaks a lower range may be seen turning southward, but soon dying out. This range is the first of the Potsdam Sandstone indicated above. Whilst the range as a whole is a very distinct feature of the landscape, it is found to consist of a succession of higher points, with low places or gaps between.

Mt. Parnassus, north of Talladega, is one of the well known land marks of this range, and the three high points near Alpine are others. The range is not continuous, but made up of a succession of short ranges, not however, following each other in the same straight line; but as one dies out, another sets in *en echelon*, a little to the east or west of it, and thus the chain is prolonged. Through the gaps thus formed pass the various roads leading from Talladega to the ferries on the Coosa. The highest of the three points at Alpine, measures by the aneroid barometer 1,000 feet above the level of the rail road at the station, or 1,495 feet above tide water.

The height of Mt. Parnassus, I have not measured, but it cannot be much less than that of the Alpine peak.

The chains of Potsdam Sandstone often end abruptly, and after several miles of level country, begins another chain quite as abruptly as the other ended. The geological position of the sandstone is quite simple in this county. It is

bounded on the west by the strata of the Quebec Dolomite, being brought up to that level by the faultings so common in the region of the Appalachians. The eastern flanks of the mountains and a strip of varying width at their feet, are usually formed by the shales of the Quebec formation, which are in turn succeeded by the Dolomite, which then covers the country to the next fault by which the Acadian slates are brought up to the day.

It is probable that the Calciferous Sandstone intervenes in most places between the Potsdam Sandstone, and Quebec Shales, and, in truth, in those gaps left where one chain ends and the other begins, it is often found.

The rocks are sandstones chiefly, with some fine grained conglomerate, with pebbles not larger usually than grains of wheat. Characteristic markings in most places, are the sandy rods caused by the boring of a marine worm *Scolithus linearis*, into the yet soft sands of that ancient sea-beach, and the subsequent filling in with sand of these worm burrows, so that when the loose material of the old sea shore was compacted into a rock, these traces were preserved. These scolithus rods are extremely abundant in some localities of the Potsdam Sandstone, whilst others appear to lack them altogether. I have not observed any other fossils in these rocks in Alabama.

In making the ascent of the mountain at Alpine, at its base is seen an outcrop of shaly, cherty limestone,* belonging in all probability to the Dolomite of a later formation, which has been brought up by faulting to a level with this. At one point half way up the mountain there is exposed a bluff of sandstone, striking about five degrees east of north, and dipping about eighty-five degrees to the south of east. One layer here exposed is a black ore of iron, with somewhat resinous lustre, fragile, and having somewhat the appearance of coal.

A partial analysis of this, by Mr. Britton, shows the following composition:

*This rock affords some beautiful specimens of oolitic limestone.

Metallic iron	56.74
Insoluble siliceous matter (white sand).	0.76
Sulphur	None.
Phosphorus	1.52
Manganese	Trace.

An exceptionally large amount of phosphorus, equivalent to about 3.00 phosphoric acid, is the noticeable feature of this curious ore.

A thin coating of limonite is seen in many places on the exposed faces of the rock, and, indeed, here as well as elsewhere, the Potsdam Sandstone seems to hold a considerable quantity of iron, either as pyrite or as its decomposition product, limonite.

Near the summit, the heavy ledges of sandstone which form the crest of the mountain begin. On account of the thickness of these beds, the rock appears almost massive at times, but where the bedding could be made out the strata show a dip of between 85 degrees and 90 degrees towards the south-east. Upon the summit of this and other mountains of this formation, are huge piles of rocks, the broken remnants of once continuous ledges. Upon these a scanty growth of oak, usually gnarled and often stunted, prevails; whilst under foot, the crevices between the rocks afford favorite retreats for the rattle-snake and black-adder. Other forms of life are rarely seen upon these bleak hill tops, except a clumsy black grasshopper, spotted with red, which is a constant denizen of the most barren soils.

From the bold and abrupt manner in which these hills rise from the surrounding plains, fine views are nearly always to be had from their summits, so that the ascent of them more than repays the geologist for the fatigue endured, in giving him, so to speak, his geological bearings. In this case, to the westward across the Coosa were the blue outlines of the hills of the St. Clair (Coosa) coal fields. North-eastward stretched the chain of Potsdam Sandstone, from the point where we stood, far beyond Talladega. Eastward were the mountains of the Metamorphic with the subordinated hills of Acadian slates and conglomerates on this side; between, lay

the valleys and cherty ridges of the Quebec Dolomite. Southward, the broken country known as the Kahatchee Hills, showed some system in its structure when viewed from this elevated point.

The large amount of iron in the sandstone of this formation is shown by the chalybeate springs which have their sources in the mountains. A very fine spring of this kind is the Chocco Spring of Mr. Jarrett Thompson, some three or four miles north of Talladega. Near this spring, also, a considerable show of limonite is found, which seems to belong to the sandstone, though it may belong to the overlying Dolomite.

North-east of Talladega, on Mr. Bowie's place, is another strong chalybeate spring at the foot of the mountain.

3. Calciferous or Knox Sandstone.

On the eastern flank of the range of Potsdam Sandstone, which was the subject of the preceding section, it is probable that a fringe of Calciferous Sandstone will be found, though as yet I have not certainly identified it.

Some three or four miles west of that range, however, there is a very fine exposure of it at the Jackson Shoals on Choccolocco creek, in S. 22, T. 17, R. 5, E., about eight miles due north of Talladega. At this point a sharp comby ridge of Calciferous Sandstone, striking north-east and south-west, is cut through by the creek, forming beautiful shoals for about half a mile. The section of Calciferous strata here, beginning at the foot of the shoals and going up stream, stratigraphically also, from below upwards, is—

1. Alternations of sandstones and shales, 800 to 900 feet thick. The colors of these rocks are exceedingly characteristic, buff, gray, and chestnut brown, the latter color prevailing. The shales graduate into shaly argillaceous sandstones, and these into hard compact sandstones, which often show a large amount of green glauconite grains. By the weathering of these portions of the rock, the outer surface has a very dif-

ferent color from the inner, being a yellowish brown, from the oxidation of the glauconite, whilst the unaltered interior of the rock is a decided green.

The softer shales between the harder sandstone ledges, wearing away more rapidly, have left these projecting in a series of dam-like ridges, striking across the creek, and over these the water tumbles in small cascades.

2. Light gray dolomite, usually quite cherty, though some parts of it are pure enough to furnish tolerably good lime—60 feet or more.

3. Sandstones, with smooth shining bedding planes, which often show ripple marks, and fucoid impressions. These rocks are sometimes almost shales, sometimes tolerably thick bedded. The color is generally a reddish or chestnut brown, with some gray layers. Thickness about 60 feet. This forms the upper sandstone barrier, or the beginning of the shoals, and the more rapid wearing away of the shaly strata, brings into prominence the harder sandstone, as in 1.

4. Almost black limestone, which passes below into the sandstone No. 3. About 20 feet of this exposed.

These rocks all dip south-east at an angle of 40 degrees or more, and the entire thickness of the strata exposed, I have estimated at between 900 and 1000 feet, which is probably not far from the truth.

From the Jackson Shoals this Calciferous ridge stretches in a direction a little east of north, across Blue Eye creek, towards Cane creek in Calhoun county, about the center of T. 15, R. 6, E.

I have not personally traced this ridge, and give the above on the authority of Senator A. Cunningham.

The fall of water at the Jackson Shoals is over 25 feet, and as the creek is a bold full stream, the amount of water power can easily be imagined. There would be very little difficulty in constructing the dams, as the sandstone ledges form themselves tolerably good dams already.

4 (*a*). Quebec or Knox Shales.

The Potsdam Sandstone range west of Talladega is fringed

on its eastern foot by a varying width of these shales. At the town of Talladega the shales are found as far eastward from the mountain as the rail road depot. The town is, therefore, upon the line of junction between the Shale and the overlying Dolomite; the strata of both formations being found within the city limits.

In going south-west from Talladega to Alpine, along the eastern side of the Potsdam Mountain, our road lies, in great part, over these shales. Their general character is the same wherever I have seen them in Alabama and Tennessee, yelow, buff, gray, greenish, and reddish-brown colors prevailing. On the Stone's Ferry road, beyond Mr. Turner's, the shales show thin-bedded sandstones, with ripple marks, interpolated between their layers, and at Mr. Dick Hillsman's these shales *seem* to be underlaid by a shaly or flaggy limestone, almost black, and very fine grained and compact. It is, at this place, characterized by the occurrence in it, or between its layers, of concretions of dark hornstone. These concretions look like rounded water-worn pebbles or boulders, and their true nature is revealed only when broken open.

Beyond this comes the range of Potsdam Sandstone. It is quite probable that some of the strata which I have just described belong to the underlying calciferous formation, though at this point a line of demarcation between them is hard to draw.

At Alpine, or rather at Plantersville, the shales are found skirting around the southern end of the Potsdam chain, which dies out abruptly at this place.

Of *useful material* in this horizon, I have none to enumerate.

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4 (*b*). Quebec or Knox Dolomite.

Distribution and Topography.

The greater part of the superficial area of Talladega county is made by the rocks of this formation.

For convenience, its occurrence in the Kahatchee Hills will be considered separately.

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The Potsdam range, stretching from the Choccolocco southwestward to Plantersville or Alpine, divides the Dolomite in the northern part of the county into two areas. By referring to the details of Shelby county, it will be found recorded that a strip of Knox Dolomite lies between the Coosa coal fields and the river. This continues across the river and makes the country as far eastward as the Potsdam chain, with the exception only, so far as noticed, of a ridge of Calciferous and Knox Shale which crosses Choccolocco at the Jackson Shoals. Eastward of the Potsdam chain, I have noticed no other rocks than those of this period, until the hills of Acadian slates are reached; a distance of four to six miles. In general, that part of the county west of the Potsdam chain is somewhat broken, and extremely barren, with the exception of a few favored spots. The reason for this lies in the fact that the chert of this formation covers very considerable areas there, and where that is the case, pine barrens are found. I need only to refer to the country traversed by the road from Talladega to Collins' Ferry; also along the road between Alpine and Glover's Ferry.

A large tract of country between Alpine on the north, the Kahatchee Hills on the south, and the Acadian Hills on the east, is somewhat rolling, but good farming land, and many valuable farms are found there. The strip five or six miles wide between the Potsdam chain and the Acadian Hills is the most attractive, perhaps, of any part of the county. Most of this has a deep red fertile soil, and many fine plantations and elegant villas are seen from the valley road.

Geological Details.

On the road from Gadsden to Talladega, where it enters Talladega county from Calhoun, barren hills covered with chert prevail, as far as section 16, township 16, range 6, east, near Mr. Dill's, where a valley road begins and is followed to Eastaboga, and south-westward to the Jackson Shoals on Choccolocco creek. This valley, or succession of valleys, is characterized by a deep red colored, and apparently fertile soil, in which is found much limonite. At Mr. Dill's a fine

spring is the source of Blue Eye creek, which flows thence west-ward into the river.

Turning west-ward from Eastaboga we come soon, (four or five miles,) to the ridge of Calciferous Sandstone, which has been described in a previous section, as forming the Jackson Shoals.

Beyond this ridge towards the south, there is a fine tract of farming country, with considerable surface show also of limonite, for several miles, to the foot hills of the Potsdam range so frequently mentioned.

On the eastern side of the range comes the strip of Knox Dolomite, which will be discussed below.

Turning westward within four or five miles of Talladega, without crossing the Potsdam mountain, we find a broken country underlaid by the chert, all the way to Collins' Ferry on the Coosa. One exception to this may be given in Howell's Cove, a very attractive valley, lying hemmed in on three sides by sterile hills.

Where the chert prevails, as it does in the area under consideration, the characteristic features of this portion of the Dolomite (probably the upper part,) are well seen. For eight or nine miles, is a succession of hills or ridges, covered with angular fragments of chert, and timbered with a growth of long leaf pine. Of other forms of vegetation, with the exception of asters, and a few hardy plants, there is little to be seen. In the little valleys, and frequently also upon the ridges, ledges of cherty dolomite crop out, and where calcareous rocks are not actually seen above ground, their presence may be inferred from the numerous "lime-sinks" which characterize this region. In one of these "sinks," section 34, township 17, range 4, east, ledges of a fine grained drab-colored impure dolomite overhang the entrance of a cave, in which "tripoli," or fine white powdery silica, has been found; it is probably the residue from the decomposition of cherty dolomite. The rock which overhangs the cave has the characters of a good lithographic rock, though I do not know that any actual test of it has been made by the owner, Mr. Thos. A. Cook, of Plantersville.

Such a sterile soil has, of course, few attractions for the farmer, and we find the country almost uninhabited, except along the banks of the streams which water it, and these are few in number.

Further south-west a similar region in almost every respect is crossed by the road from Plantersville to Glover's Ferry.

Three or four miles north of west from Plantersville, is another occurrence of what has been called lithographic stone, on the land of Mrs. Stone.

The cherty hills in this locality are not rugged and broken like some of those further north, but gently undulating, showing only occasionally fragments of the characteristic chert.

Along the crest of a hill some 100 to 150 feet above a wide open glade, the lithographic stone is exposed in ledges, striking north 15 degrees east, and dipping 15 degrees south-east, at an angle of 45 degrees.

Just above the upper ledge of the rock, and covering it with a sharp projecting comb, like that of a roof, is a thin stratum, 10 to 12 inches thick, of calcareous shale, which weathers dark brown. The limestone itself shows a thickness of twenty to thirty feet. Some of it is exceedingly fine grained and compact, and I should be much disappointed if it will not answer well as a lithographic stone. It will probably also answer well as a cement rock.

The limestone seems to be quite free from pyrite; but the overlying shale is full of it.

From the weathered surfaces of some of the limestone, project lenticular and cylindrical concretions of hornstone, and these, detached from the limestone in its disintegration, lie scattered about the slopes of the hill, and their curious shapes have attracted much attention, and given rise to many stories of the occurrence of fossil fish, &c., there.

It is quite probable that the shales overlying the lithographic stone, will, upon closer examination, be found to be fossiliferous.

From the same formation, on Mrs. McKenzie's land, is another occurrence of lithographic stone, which has been thoroughly tested by experts, who have given very favorable

reports. Unfortunately I missed seeing this locality, and am able to give no information concerning it except at second hand. In Prof. Tuomey's time, this stone was known as a good hydraulic limestone.

West of Mrs. Stone's quarry towards the river, the land is gently undulating, but apparently not fertile, the timber being chiefly long leaf pine, with little or no undergrowth.

In section 15, township 19, range 3, east, a chert ridge ends abruptly in what is known there as the Calhoun mountain. The summit of this little mountain is about 350 feet above the level of the Coosa river. The slopes of the hill are covered with fragments of the chert full of rhombohedral cavities caused by the removal of dolomite crystals. A ledge of dolomite about three fourths of the way to summit, has been burned for lime, but it is too siliceous to make a good lime. The strata strike nearly north-east and south-west, and dip south-east.

The mountain is only about two miles long, the north-eastern end of it gradually sinks down to the general level of the elevated rolling country mentioned just above.

Near the foot of this mountain, in section 16 or 21, township 19, range 3, east, is a very large pond spring, the source of a beautiful little creek, called Clear creek, which flows into the river about three miles from its source; about one and a half miles direct distance. A large mill, (Frederick's) is located on Clear creek, a few hundred yards from its mouth. Below the mouth of the creek, at the ferry, a whitish cherty dolomite is exposed; it has been burned for lime, but like that from Calhoun mountain, it is too siliceous.

From this exposure it was difficult to ascertain the strike and dip, but the former seemed to be a little west of north, and the latter south of west at a high angle.

Some two miles east of this, on Mr. Byar's land, a fine grained siliceous dolomite is again seen, with seams or layers of hornstone. The rock here lies nearly flat, and as a consequence the strike and dip were not easily determined. As well as could be ascertained, the limestone strikes north-east and south-west, with a slight dip to north-west. If these di-

rections are correct, it would show that the disturbance caused by the uplifting of the Potsdam Sandstone, (which terminates some six or eight miles north-east,) involved also these rocks. The siliceous dolomite under consideration has been pronounced a lithographic stone, for which it may answer, if not too hard and too coarse grained. It is the property of Mr. James Burt, of Mardisville.

From here, towards Plantersville, a succession of cherty ridges is crossed. At Mr. Cook's, two miles from the town, there is a limonite bank showing very good ore, and thence on to Plantersville are many outcrops of the ore.

In S. 19, T. 19, R. 4, east, near the residence of Col. E. R. Smith, the ore is seen in considerable quantities at the base of a little hillock composed of a porous ferruginous chert.

In this neighborhood I noticed frequently that masses of friable porous chert were imbedded in the red clay of the low grounds, not being confined as usual to the ridges. Its rotten, porous character accounts for this.

The Dolomite, between the termination of the Potsdam chain at Alpine, and the beginning of another in the Kahatchee Hills, near Childersburg, seems to extend unbrokenly from the river eastward to the Blue Mountain. It is probable, though, that between the two Potsdam Sandstone ranges the fault continues, with less vertical displacement, however, since it only brings the lower subdivision of the Dolomite up to the level of the upper. This is rather a surmise than a demonstrated fact, as I am not sure that the barren cherty hills belong to the upper part of the dolomite, although such is probably the case.

It remains now to speak of the narrow strip of this formation lying between the Potsdam range and the Acadian slates. The S., R. & D. Rail-road skirts along the base of the former range for some distance, and the region now to be treated lies mostly between the rail-road and the hills or mountains to the east.

In the lower part of township 20, range 4, east, Pope Mountain forms a very prominent land-mark. It is with the region

north and north-east of this mountain that we are here concerned.

Near the junction of the Quebec Shale and Dolomite on the eastern side of the Potsdam mountain, a series of thin bedded flaggy argillaceous limestones is usually encountered. This may belong in part to the shales. At Talladega, an outcrop of it may be seen in the eastern part of the town; there it is fossilerous, though no well defined forms have been gotten from it.

At the spring in the southern or south-western edge of the town, a thin-bedded flaggy limestone (or dolomite) is seen striking north-east and south-west, and dipping at a moderate angle south-east.

Further south-west near Alpine, at Reynolds' Mill, a similar rock may again be noticed.

I have already spoken of the discontinuous character of the range of mountains of Potsdam Sandstone west of Talladega. In the gaps between these elevations the Dolomite skirts around, and very often considerable beds of limonite are found associated with it. In going from Talladega due north, the road crosses beds of the Quebec Shales, with little bands or tongues of dolomite holding limonite, and in the gap near the Poor House in sections 10 and 15, township 18, range 5, east, there is a large bank of this ore. In the immediate vicinity, on Dr. Vandiver's land, a yellow ferruginous shale is found in great quantity, showing in many places a good ore of iron.

Half a mile or more from the Poor House, on Mr. Watson's land, is another bank of ore of very fine quality.

At the foot of Mount Parnassus, a few miles north-east of this, on Mr. Bowie's farm, again limonite occurs in quantity.

At the localities near the Poor House the ore banks are shut in by the hills of Potsdam Sandstone, and its connection with the Dolomite can be seen only by tracing this around through low gaps, between successive elevations of the sandstone.

South-west of this, near Chocco Springs, the occurrence of limonite has already been spoken of, as apparently belonging to the Potsdam Group, and the same remark applies to an-

other bank on Esquire Lawson's land, near by, which is found, out in the hills of sandstone.

I refer these provisionally to the Dolomite, though their actual connection with it has not been actually demonstrated. They may *possibly* be occurrences similar to one to be described further on at Oxford, Calhoun county.

In a section across this belt now under discussion, from the sandstone hills, south-east, to the Acadian slates, we find next a succession of chert ridges and intervening valleys, which characterize the Dolomite, making up the rest of the country to the eastern limit of the formation.

Most of the soil throughout this belt is a stiff clay, colored deep red by iron, which is in numberless localities aggregated with true ore banks. This region is one of the best farming tracts in the country, for the chert ridges, though characteristic, do not cover the greater part of the country, as is the case west of the Potsdam Sandstone. It is likewise much more thoroughly charged with iron than farther west, so that this belt of the Dolomite adjoining the Metamorphic is noted for being richest in iron ore of any in the county.

Since the ore probably comes from the decomposition of a highly ferruginous limestone or dolomite, this belt shows a greater predominance of calcareous rocks than the western, and also a more thorough disintegration of the strata than that. To this wearing down of the strata may be attributed also the great quantities of clay which characterize the region. On this point see, also, above in the General Geological Summary. Before going into details respecting the occurrence of ore banks, I may here notice, that at the extreme eastern edge of this Dolomite, from Talladega Springs, north-east into Georgia, a bed of crystallized marble is found, just at the edge of the Acadian slates. This marble, in the region of the disturbance caused by the elevation of the Kahatchee Hills, is very beautiful statuary marble, and it has been described by Prof. Tuomey, and analyses have been published by him.

Further north-east, in S. 18, T. 20, R. 5, east, at Bowie's quarry, formerly Herd's, the marble lies in well defined beds, striking almost due north-east and south-west, and dipping

south-east about 45 degrees. It is white, and banded with blue; and about thirty feet thickness are exposed. Overlying it is a deep bed of red clay, with fragments of semi-metamorphic slates; and this relation between the marble and slates may be seen at any of the outcrops.

Below the marble, in the fields, there is much chert, which, however, does not exhibit so much of the angular fragments seen elsewhere; indeed, it approaches very nearly the character of a sandstone, though evidently once filled with calcareous matter, as the porous nature of the rock shows.

Again, in section 12, township 19, range 5, east, at Dr. Taylor's, and at Mrs. McKenzie's, the same marble is found under like relations. Analyses of two specimens from Dr. Taylor's quarry were given in my report for 1874, and need not be repeated here.

Above this, I have not personally examined any outcrops of the marble, though I have information of its occurrence all along the eastern edge of the Dolomite.

As to the age and geological position of this marble, there is reason to believe that it is a metamorphosed dolomite of the formation now under discussion.

In the region of the Kahatchee Hills, (see below,) this rock is more perfectly crystallized, and we find associated with it silicates of magnesia, which may have been derived from the chert and magnesia of the dolomite. Further away from this area of disturbance, we find the metamorphism less perfect, though still very considerable, caused by the uplifting of the Metamorphic hills to the east.

We may reasonably expect some day to see this belt of marble become valuable property. At present there is little demand for it, though some years ago quite an extensive business was carried on by Dr. Gantt, Mr. Nix, Messrs. Herd, and others.

We may now take up the occurrences of limonite. The geological features of this belt, are much the same throughout, so that the description of a few localities will suffice for all, it being borne in mind that I have been able to examine a few only of the more prominent ore banks.

A short distance north of Bowie's marble quarry, a
section 1, township 20, range 4, east, and section 6, tow
20, range 5, east, on the road to Talladega, is a long re
on which is the residence of Mrs. Hannah E. Reynolds.
along the sides of this hill smooth pebbles of limonite
also larger fragments abound. Beyond the house, in
tion 6, a large field, inclosing about one square mile, is
ally covered with the ore.

I have not as yet been able to obtain an analysis o
ore from here, but this omission will be filled in a subse
report. I have very little doubt that the ore will prove
of the best quality.

Specimens of this ore show all the varieties of con
fibrous, ochreous, &c.

The hill upon which the greater part of the ore is f
affords a fine site for the erection of a furnace, as it
looks a little creek, and is not far distant from the ba
marble which will afford an admirable material for the f

Arrangements were in fact made some time since fo
erection of a furnace here, and the day is probably no
distant when it will be built. Transportation is alwa
item of the first importance in such undertakings, and
proposed rail road from Syllacauga to Talladega will
this point in direct communication with the market, an
speedy utilization of the stores of marble and iron ore
be the natural result.

Between Mrs. Reynolds' and Talladega are many val
plantations and beautiful country residences, and this
well be called the garden-spot of the county.

At the old town of Mardisville, a sandy, flaggy dol
crops out in the road in many places, and in the midst o
town is one of those beautiful springs of clear water, w
abound in this formation, so far as it has been examined
Bibb county to Calhoun. The dolomite at Mardisville,
some places nearly a sandstone, and large masses of c
porous from the removal of calcareous matter, are abun
in the red clay soil. As might be expected with such
ciations, pebbles and fragments of limonite may be no

g the road side for half a mile or more. I have not visi- any ore bank at this place. The flaggy dolomite in Mar- lle strikes north and south, and dips at a moderate angle rds the east. The wagon road over these edges of strata, broken off pieces, is anything but good, and it is quite eable as being almost the only piece of bad road from acauga to Talladega. About four miles east from Talla- , in section 29, township 18, range 6, east, there is a large l spring several acres in extent, from which flows a tribu- to Choccolocco, and a mile further, another spring, the rs of which flow south-westward into Talladega creek.

the south-east corner of the township, and within a mile ne hills of Acadian slates, are two fine iron ore banks, known as the Seay Bank, section 35, and another, the a Bank, sections 26 and 27, the property of Mr. M. H. kshank of Talladega. The two deposits are almost, if not continuous. The ore from this place was used many s ago in the old Rob Roy Forge, and the locality, as well ne ores described by Prof. Tuomey. I have, in addition, analyses, by Mr. J. B. Britton, of ores, and one of forged from this place. To the courtesy of Col. S. S. Glidden ne Alabama Furnace, I am indebted for the analyses.

No. 1. Ore from the Seay Bank.

bined Water	11.86	
eous Matter, insoluble	7.39	
ble Silica	0.19	
ic Oxide	77.54	—54.28 Metallic Iron.
nina	2.07	
e	0.07	
nesia	0.03	
sphoric Acid	0.29	—0.13 Phosphorus.
hur	None.	
ganese undetermined, & loss	0.56	
Total	100.00	

100 parts Metallic Iron contain 0.221 Phosphorus.

No. 2. Ore from the Irona Bank.

Combined Water..............	11.52
Siliceous Matter, insoluble......	11.62
Soluble Silica................	0.09
Ferric Oxide..................	68.93—48.25 Metalli
Alumina	3.59
Manganese.......	3.77
Lime.........................	0.10
Magnesia	0.05
Phosphoric Acid..............	0.13—0.06 Phosph
Sulphur......................	None.
Undetermined, and loss........	0.20
Total.....................	100.00

100 parts Metallic Iron contain 0.124 Posphorus.

No. 3. Forged Iron from Ore from Irona Bank.

Metallic Iron....................	99.020
Carbon..........................	0.198
Silicon.........................	0.265
Sulphur.......	.000
Phosphorus.....................	0.122
Manganese	0.064
Undetermined, and loss..........	.331
Total.....................	100.000

These analyses show sufficiently well the character o ore, especially as they were made from *average sampl* lected by Col. Glidden. Whilst analyses from average ples may not always make so fine a showing as those picked specimens, yet they are the only analyses of much in giving an idea of the *general quality* of an ore bank.

Good limestone is near at hand, and the forests of pin rounding the ore beds will yield fuel enough for many The extent of this deposit is very great, and it lies abou or five miles distant from the rail road.

[M]ost of the way from this ore deposit up to the residence [of] Col. McElderry, in S. 11, T. 18, R. 6, east, outcroppings of [limo]nite may be seen by the roadside, and on the left are [mass]es of chert.

[O]n the Selma, Rome & Dalton Rail Road, in section 17, [town]ship 17, range 7, east, is the Alabama Furnace, Col. Ste[phe]n S. Glidden, Superintendent.

[T]he ore banks are in sections 16 and 17, and cover an area [of a]bout one mile square. The limonite is of the usual char[acte]r. Towards the west the ore is purer, but in the eastern [and] southern portions of the field there is mixed with the [goo]d ore much that is cherty, and a good deal of the porous [pebb]le chert that we have met with so frequently.

[A]s to the thickness of the deposits, I can say but little. I [saw] myself no pits deeper than fifteen feet, though I was told [by o]ne of the contractors, that the light-colored yellow sand, [belo]w which they had found no ore, has been reached in sev[eral] places, at depths varying from 15 to 20 feet.

[I] have no analysis of any of the ore from these banks, but [the] iron made from it meets with a very ready sale.

[T]he limestone at present is gotten from a layer in the dolo[mite] of this formation, in section 18, near the furnace. The [beds] strike north-east and south-west, and dip south-east. [The] greater part of the rock exposed at the quarry is a com[pact] bluish limestone, or rather dolomite, as shown by the [anal]yses given below. Some of the beds are of a gray color, [and] a band or seam of hornstone traverses part of it.

[T]he analyses are by Mr. Britton, and I am enabled to pub[lish] them through the courtesy of Col. Glidden, for whom [they] were made.

1. *Limestone from S. 16, T. 17, R. 7, E., Talladega Co.*

Carbonate of Lime	55 35
Carbonate of Magnesia	34.58
Siliceous Matter, insoluble	7.75
Iron and Alumina	1.48
Water, and loss	0.84
Total	100.00

No. 2. Another Limestone from same locality.

Carbonate of Lime....................	61 86
Carbonate of Magnesia.	33.55
Siliceous Matter, insoluble.............	2.86
Iron and Alumina....................	1.09
Water, and loss.......................	0.64
Total..........................	100.00

During my last visit to the Alabama Furnace, it was o
blast for the purpose of re-lining, and a large quantity
peculiar furnace scale had been taken out of the stack.

A specimen of this scale, analyzed also by Mr. Br
showed the following composition in 100 parts:

Furnace Scale.

Silica................................	1.46
Iron and Alumina....................	3.62
Zinc Oxide, Cadmium Oxide, ...	91.70
Graphite, and undetermined...........	3.22
Total..........................	100.00

Showing it to be almost entirely a mixture of zinc and
mium oxides, the zinc oxide being by far the more abu
of the two.

The presence of zinc in furnace scale from Benton c
was noticed by Prof. Mallet in Tuomey's Report, (prol
the same locality with this.)

It is noteworthy that none of the iron ores, or of the
stones analyzed from here, show the presence of zinc, v
must therefore exist in very small quantities, probably, i
limestone. Perhaps if these should be carefully teste
zinc, its reaction might be detected.

Economic Materials and Iron Industry of Tallad

In the geological details above, I have given some ac
of the principal deposits of limonite in the county wh

personally examined; and I shall not repeat them here.
localities where limestone supposed to be suited to litho-
hic purposes, have also been given. I might add, in this
ection, that near Dr. Taylor's, in section 11, township 19,
e 6, east, there is an occurrence of fine grained rock
h has been thought to be lithographic stone. I have not
it.

rings.—Of the numerous bold springs which character-
his formation, several have been mentioned already. On
Bowie's plantation, section 27, township 19, range 5, east,
is another, and on the S., R. & D. R. R. another, Kel-
spring; but to enumerate all the beautiful springs with
h this formation abounds would be impossible.

on Industry.—At present, there is but one blast furnace
e county, the Alabama Furnace.

his furnace is owned by the Alabama Iron Company,
Glidden, President and Superintendent, and James L.
Treasurer.

was started October 1, 1873, having been rebuilt on the
of a furnace destroyed during the war. There is only
stack, 41 feet high; 8 feet 8 inches across the bosh; open
hot blast; 3 blowing cylinders, 40 inches in diameter,
6 feet stroke; steam cylinder 21 inches in diameter, and
t stroke; fuel, charcoal; ore, brown hematite; ore beds
t half a mile from the furnace; limestone about the same
nce. Furnace yields from 20 to 22 tons of foundry iron
lay.

his furnace, though a small one, yields as well as any
e State. The charcoal is burned in ordinary kilns upon
grounds, and the ore also is roasted at the furnace, so
all the operations, except the raising of the ore, and the
rying of the limestone, and cutting of the wood, goes on
r the eye of the superintendent.

the future of Talladega county in the production of
there can scarcely be two opinions. The belt of dolomite
to the semi-metamorphic hills, holds ore enough for an
ense industry, and whilst other regions of the county
not so much favored in this respect, yet there are furn-

aces running in other counties upon ore banks not more
tensive than some of those enumerated above.

Want of transportation stands in the way of the impr
ment of many of these localities, and the present low p
of iron and bad market, are already seriously felt at se
of the furnaces in the State already erected.

KAHATCHEE HILLS.

Under this heading I shall speak of the geology, &
that part of Talladega county lying southwest of a line
Childersburg to the southeast corner of township 20, ra

Topography.

In the southern part of the township designated a
the Pope Mountain makes a very prominent feature i
landscape. Three miles south of this mountain, a ra
hills may be observed striking nearly due west, at f
single chain of hills, but beyond Oden's Mill, S. 13, T.
3, E., widening out towards the northwest and south
making a very broken country to the Coosa. Tending s
ward, from near the Coosa bridge, (crossing of the S.,
D. R. R.) for several miles, another chain of hills make
western boundary of this region, and in the extreme s
west corner of the county, the high hills surroundin
Talladega Sulphur Spring, marks the limit of it in that
tion.

The Tallasseehatchee flows from the hills of semi-met
phic slates of the Acadian group, eastward in the low
between Pope Mountain and the East and West
spoken of, and then turns northwest to the Coosa, into
it empties a few miles northwest of Childersburg.

Cedar Creek, rising just south of the East and
Range, near the town of Syllacauga, flows westward in
Coosa, between the western range of hills, and thos
rounding the Sulphur Springs. This creek receives o
erably large tributary, the Kataula Creek, from the hig
of the East and West Range in Township 20, Ra

ing its source in the same high hills, and at no great dis-
e from the head of Kataula, but on the opposite side of
mountain, the Kahatchee flows westward between two
gs of the East and West Range, then northward and
ward around the ends of these prongs into the Coosa
w Coosa bridge. The Coleman Fork of Kahatchee rises
the source of the latter, flows however along the northern
of one of the hills, Kahatchee being South of the
e, and joins the main creek two or three miles above its
th. Another small tributary to Kahatchee is found still
ner northward.

ne courses of Tallasseehatchee Creek and its tributaries
worthy of more particular notice. The principal tribu-
es are Wewoka and Emaughee creeks, draining from the
th; and Short and Crooked creeks from the South, whilst
head waters of the Tallasseehatchee proper, far up in the
of Acadian Slates have a general westerly course for
t or ten miles.

he Wewoka rises near the western edge of the Acadian
s and flows into Tallasseehatchee after a sinuous, but in
eral, westerly course. It cuts through a chain of hills
necting the western extremity of the Pope Mountains
the end of the chain of Potsdam Sandstone at Alpine.
orresponding to it on the south, Short Creek rises south
he East and West Kahatchee chain, cuts through it at
n's Mill, and joins the Tallasseehatchee after a short
herly course of six or eight miles.

he Emaughee and its branches, have their headwaters far
ne north and east. as high up as T. 19, R. 5, E. In their
rses they traverse almost the entire series of Acadian
es, rising, however, west of the high Quartzite ridge of
e Mountain, which is, probably, metamorphosed Potsdam
dstone. Flowing southwest, the Emaughee passes out
n the Acadian slates into the Dolomite, between the Pope
ntain and the East and West Kahatchee Range, then
s westward, joining the Tallasseehatchee between those
ntains, and three or four miles west of the slate hills.

imilarly, Crooked creek, with its branches, rising far south,

three or four miles beyond Syllacauga, and likewise nea
quartzite ridge of Rebecca Mountain or Blue Mountain, f
northeast through Acadian slates, crossing almost the e
belt of them, emerges near the end of the East and West
hatchee chain, at the falls at Vincent's Mill, and a short
tance below that it joins the Tallassahatchee.

As was intimated above, the Tallassahatchee proper ha
sources, like the others, just at the foot of the quartzite r
traverses the whole series of Acadian slates, almost dir
across the strike, and enters the Dolomite near Vinc
Mill.

Wherever I have visited the points where the creeks o
county come from the slate hills into the Dolomite, attra
cascades were seen.

The Tallassahatchee, then, reinforced by the wate
Emaughee and Crooked creeks, having thus all the drai
from the western side of the main quartzite ridge of
Mountain, from township 19, range 5, east, as far sout
township 22, range 4, east, flows westward between the
mountains so often spoken of, receives the water of S
creek, then turns northward and then northwest, to the C
receiving the Wewoka and one or two other smaller stre
which drain the dolomite belt, the Wewoka rising just i
edge of the slate hills.

The Tallassahatchee, unlike Talladega creek, is a
stream, the distance from its source to mouth in a str
line being not much more than eighteen or twenty miles
near the slate hills it sends out its long feeders, the Emau
and Crooked creeks, and collects the waters for many
north-west and south-west.

Talladega creek, as was stated above, rises far out am
the Metamorphic hills, cuts through the quartzite of
Mountain, crosses the Acadian slates, but receives very
accession to its waters west of the quartzite ridge.

The hills or mountains of this region, which are ele
500 to 800 feet above the level of the plain, are often
steep and precipitous, especially on that side where the br
edges of the strata overhang the plain. Between the

al mountains which make up the region patches of level le farming land are frequently enclosed, and, protected by high mountains from too abrupt changes in the weather, areas are sometimes favored spots, where fruit and growcrops flourish long after blighting frosts have fallen upon ining tracts.

Geology.

he geological formations represented in this area are—

). The *Acadian Slates and Conglomerates*, on the east. sibly, also, some of the semi-metamorphosed slates found the flanks of the mountains may belong to this group, gh they belong chiefly, I believe, to a higher group.

). *Potsdam Sandstone.* This makes the mass of the mouns, the sides of which show usually outcroppings of

). *Calciferous or Knox Sandstones*, sometimes half-metaphosed; and lower down in the edges of the valleys, (4) the es of the *Quebec Group* likewise, also half-metamorphosed, gh sometimes unchanged. The greater part of the low s and their cherty ridges, together with the metamorphic talline limestone, or marble, lying next adjoining the Aca-, I have referred to (5) the *Dolomite* division of the *Que-Group.* I have reason to believe that (6) the *Black Shale* be found at the foot of the Potsdam Sandstone ridge the Sulphur Springs, and also at another point five or six s south-west of Childersburg.

ith this enumeration of the formations, I shall go on to ribe in detail this region as a whole, and not, as hereto-, the formations *seriatim*.

ince the Pope Mountain, above referred to, is a prominent ct, and as its structure is characteristic, it will form the ting point of our description.

he old plank road crosses this mountain in sections 27 and ownship 20, range 4, east, near the residence of Mr. S. B. zener; the place of crossing being a comparatively low gap veen two knobs, one east and one west of the road. The s of the mountain is made up of a siliceous sandstone occasionally some fine conglomerate. On the summit of

the knob to the west of the road, we find these sandsto
heavy bedded and having all the distinctive features of
sandstone of the Potsdam chain further north, except tha
have not discovered, as yet, any traces of the peculiar *scoli*
rods. The strata strike nearly due east and west, and
north. Upon the summit, associated with the heavy bed
sandstones and conglomerate, are great quantities of thin
thick bedded sandstones, impregnated with magnetite to s
a degree that fragments of the rock show strong polar
The usual color of these magnetite-bearing rocks is gray, tho
after long exposure the color is usually darker, sometimes
proaching to black. Besides these, we find on the knob
of the road many pieces of sandstone with lamellæ of an
ore which has the appearance of specular ore, without, h
ever, its red streak.

This metallic substance is found as a crating, sometimes
an inch or more in thickness, and the richest specimens
ally show very little polarity, often none at all. These he
bedded sandstones and conglomerates I have referred to
Potsdam Group. Coming down the southern face of
mountain, sandy semi-metamorphic slates are first passed o
and then a very siliceous limestone or dolomite, alterna
with strata of a shaly limestone, (the shaly parts so alte
as to resemble the talcoid slates of the Acadian group.) S
of the limestone is pure white in color, and of compact
ture, but upon weathered surfaces it is seen to be chiefly
ceous matter. The limestone beds exposed on the hill-
(30 to 40 feet in thickness) seem to vary considerably in t
contents of silica; none of it, however, has been found
enough to make good lime. Below these beds are fragm
of semi-metamorphic slates, with more abundant fragm
of sandstone, similar to that at the summit, down to the
of the hill, where the Dolomite and its chert of Quebec
begin and fill the interval between this and the mountain t
miles further south.

Below the limestone I saw no rocks in place, and the f
ments of slates and sandstones covering the ground may l
rolled down from above.

Some of the difficulties in deciding upon the ages of the
ks entering into the structure of Pope mountain, may as
ll be set forth here, since the same difficulties are encoun-
ed elsewhere in this interesting region. If the sandstone
l conglomerate at the summit of the mountain be Pots-
n, then in coming down the southern slope, and crossing
strata in a descending sense geologically also, (since they
dip northward,) we find under the sandstone a series of
ndy semi-metamorphic slates, possibly Acadian, and below
se and dipping under them, the siliceous limestone, the
ly strata of which have been changed into semi-metamor-
ic slates very much like those just above. The limestone
found more than three-fourths of the way up from the foot
the mountain, and, consequently, not very far from the
mmit. The strata of dolomite, &c., unchanged, lie in the
ley enclosed between two ranges of these hills. If the
ite siliceous limestone and slates, belong to the Dolomite,
I am inclined to think they do, then they have been in-
ved in the mountain making, have been partially metamor-
osed, and are separated from the Potsdam strata, which
y *appear to underlie*, by a fault which is not far from the
st of the mountain on its southern face.

Going northward over the mountain we cross nothing but
sandstones to the foot of the mountain, when the Dolo-
te is entered and it continues to be the prevailing forma-
n northward and eastward to the Potsdam chain west of
lladega. I did not notice any rocks which resembled the
lciferous sandstone and Quebec shales, on this northern
pe, but as my observations were confined to a very limited
ea, I presume that upon closer examinations they would be
nd.

In section 36, township 20, range 4, east, or opposite the
stern end of Pope mountain and between it and the hills
the Acadian slates, are the marble quarries formerly owned
Mr. J. M. N. B. Nix, and Messrs. Herd; at present the
operty of Mr. Bond. The quality of this marble was in-
stigated by Prof. Tuomey and his analyses and report upon
are sufficient proof of its excellence. The stone has been

quarried in several places and exhibits several varieties, p
white, light blue, banded blue and white, and dark blue.

It is very evidently bedded, and the stratification pla
are utilized in the quarrying. Upon the surfaces of th
bedding planes, which strike due north-west and dip 5 d
to 15 deg. north-east, are marks of joints which cross e
other at an oblique angle, two to four feet apart, thus di
ing the marble into rhomboidal blocks.

How deep these joints extend is not known, as very li
marble has yet been gotten except at the surface. The r
is much water-worn. More than fifty feet thickness of s
marble are here laid bare.

Above it come heavy layers of irregularly bedded cu
knotty, shining greenish slates of the Acadian group, hy
mica (talcoid) slates. At one point some twenty feet th
ness of these slates can be seen directly super-imposed u
the marble, and, so far as the dip, &c., go, *conformably*.
however, as is supposed, the marble belongs to the Que
Dolomite, the Acadian slates have been pushed over u
the Dolomite, having been displaced by a fault. In sectio
township 21, range 4, east, half a mile or more south of
above occurrence, marble has also been worked in times p
In the same section, near the residence of Mr. Frank Sl
rill, are occurrences of smooth, fine grained, fissile slate
a bluish drab color, from which roofing slates may poss
be obtained. No explorations have been made for the sla
and all I saw were weathered surface specimens. Th
were rather soft, and not fissile enough to serve the purp
of a roofing slate, still, better ones may be uncovered.
slates are similar to those occurring west of Dr. George H
further south, and with those I have considered them t
slates of the Quebec Group, partially metamorphosed.

In the strike north-west and south-east, and dip north-
of the marble, and overlying slates, it will be seen that
strata appear to *bend around* the end of the Pope mount
the strata of which strike east and west. This point will
noticed again below in speaking of the range of hills
crossed in going south.

From the western end of Pope mountain a chain of hills
tends nearly due north to the end of the Potsdam chain at
pine.

Wewoka creek cuts through this range near section 16,
wnship 20, range 4, east. Of the structure of these hills I
n say nothing from personal observation, though I suspect
at they are of the same nature with the Pope mountain.

Going southward from Pope mountain, across the valley
rough which flows the Tallasseehatchee, a second range is
ssed near the middle of township 21, range 4, east. This
ain begins in section 15, township 21, range 4, and strikes
e west, as far as section 15, township 21, range 3, east, then
dens out towards the north-west and south-west making
e Kahatchee Hills. The east and west chain is crossed by
e plank road, at what is known as the plank road gap, in
tion 16, township 21, range 4, east, and is cut by Short
ek at Oden's mill, section 18, same township and range.

At the eastern extremity of this range, where it comes
se to the hills of Acadian slates, Crooked creek, which
es amongst the Acadian slates several miles south or south-
st of Syllacauga, and flows north-east into the Tallassee-
tchee, tumbles over the rocks in a series of cascades at
ncent's mill. This is a locality which promises to reveal
ne facts of interest and will be more particularly examined
a future time.

In the plank road gap the following section of rocks is ex-
sed, in *descending order* from south to north:

1. Dolomite and chert of the Quebec formation—at foot of
untain.

2. Flaggy sandstones in fragments covering the southern
pe—no rocks seen in place.

3. Very near the summit semi-metamorphic slates, like
ny slates of the Acadian group.

4. Below the summit, on northern side of mountain, and
ectly under and conformable to the slates, are limestones,
en impure cherty, and shaly, (shaly layers semi-metamor-
ic or talcoid slates,) and alternating with light colored

shales—whole thickness of the limestone strata thirty to f
feet.

5. Below this the rocks pass into shales, and lastly
sandstones, like those seen on the southern slope of I
Mountain.

6. In the valley of Tallassahatchee, Quebec Dolomite.

These rocks strike east and west, and dip south.

The similarity of the strata here crossed and those forn Pope Mountain can not fail to attract notice. The two mo tains are parallel, and their strata dip in opposite direct from each other, with a Dolomite area between, as tho they formed parts of an anti-clinal fold. The structur the country at the eastern extremities of these two mounta when more closely examined, may throw much light u this point.

At the plank road gap, very little of the sandstone and glomerates which characterize the summit of Pope Moun are shown, but to the east and west of the crossing, upor higher points, these rocks, as well as the associated magne bearing sandstone, are quite as abundant as there. The l stones alternating with semi-metamorphosed slates, and l directly under a heavy bed of these slates, are repetitior what were seen at the Pope mountain.

Following this East and West Chain to where Short c cuts through it at Oden's Mill, another very good section be obtained. Remembering that the strike is east and v and the dip south, we find north of the ridge a rolling of Quebec Dolomite; at the foot of the hill are sandy s metamorphic slates, with white cherty limestone, (quarrie lime east of the mill, but too flinty to make a good art This limestone, with its slates, may be seen near the sum and following it are heavy-bedded sandstones, and with a stratum (2 to 3 feet in one place where cut through in r ing a road,) of solid sandstone charged with magnetite, r fragments of it showing strong polarity.

The southern slope of the hill is made up chiefly of gr ish, soapy-feeling half-metamorphosed slates, a little less

e than the so-called talcose slates, but otherwise very
 like them.
low these slates, with which sandstone ledges are often
iated, we come upon cherty dolomite once more.
is section, like that over the mountain at the plank road
is at a low place, and the structure of the mountain at
 two places differs slightly from that at the Pope Moun-
and also at the high points westward which remain yet
 described.
m free to confess, that the exact relations of these rocks
ot altogether clear to my mind, and that whilst I can re-
e heavy-bedded sandstones and conglomerates, making
e main mass of the mountains, to no other horizon than
of the Potsdam Sandstone, the thin beds of half-meta-
hosed slates under them, and they in turn underlaid by
nations of limestones and similar semi-metamorphic
, are quite confusing, though all that I have observed in
region makes the explanation given above, in considering
 Mountain, appear to me most probably the true one.
om Oden's Mill westward for three miles, the ridge is a
e one; but near S. 15, T. 21, R. 3, east, it divides into
 or more distinct ridges, north-west, west, and south-west,
ctively, and become dividing ridges between Kataula,
atchee, and Coleman's Fork. In S. 16, T. 21, R. 3, east,
e summit of the mountain, there is a depression called
Dry Pond, which at certain seasons of the year is filled
 water, which drains off towards the south into Kataula,
towards the north into Kahatchee. This Dry Pond is
 the point where the undivided range terminates, and the
ching begins.
e most northerly of these branches curves off first north-
, and then nearly north, making a sort of arc of a circle.
s the highest peak in this vicinity, that just back of the
lence of Mr. Albert Crumpler, and as it has no other
e, I shall call it Crumpler's peak. Its elevation above the
road level at Childersburg is 800 feet, and on that side
looking the plain towards the east and north, it is very
p and precipitous, many places near the summit showing

an exposure of sandstone cliffs many feet in thickness. structure of this mountain is a type of that of all the ot in the region, and I shall therefore give it more in detail.

The summits of this and other ridges of the kind are q irregular, some points being 200 to 300 feet higher than ers. The highest points are always covered with huge bl of sandstone, piled in confusion upon each other, so tha undisturbed ledge, or one in place, is not very often seen.

In the lower places a kind of shaly sandstone, someti almost shales, are always found. These shales have a bro ish yellow color. It is rather strange to meet with this a nation of harder and softer strata in going *along* the *stri* the rocks. Such alternations would naturally be found in ing *across* it. The strata here dips towards the south, so west, and west, according to the direction of the strike. low the summit on the east and north sides, and geologic below the sandstone, are sandy half-metamorphosed, gree slates; then limestones partly gray and cherty, partly b with argillaceous bands, and partly a very fair blue limes that makes an excellent lime. Below this again the part metamorphosed slates like those above, passing downw into the unchanged dolomite of the valley.

A section showing the actual contact of the sandstones the slates, I did not see on this ridge, though such an has been described above at the Pope Mountain, with w this has many points in common.

Northward from Crumpler's Peak, and a mile or two from Childersburg, similar sandstones and greenish half-r amorphic slates make up a small ridge about 350 feet in he above the rail road level.

These sandstones and slates at the point where I obse their outcrops, section 30, township 20, range 3, east, st north 15 degrees east, and dip about 5 degrees towards south-east. With the rocks above mentioned are found fragments of the sandy magnetic rock seen at Oden's Pope mountain, &c. Upon Crumpler's peak I saw non the latter rock. In section 31, just south-west of the loc described, is a large bank of what appeared to be a very g

nite. Still further south-west, in section 36, township 20, e 2, east, upon the sides of a cherty ridge, is a fine ex-re of cherty sandy dolomite of the Quebec Group, which fills in the interval between ridges of Potsdam Sand-.

return now to Crumpler's peak. Between this, and the spur of the ridge towards the south, flows the Coleman of Kahatchee. After descending the mountain the try between the ridges is generally Quebec Dolomite, gh curly, hydro mica slates are generally found upon the s. I have information, which seems to be tolerably ble, that in section 7, township 21, range 3, east, there is currence of what has usually passed for coal, but which all probability, the Black Shale. Between the middle and the southern one flows the longer branch or fork of tchee, through a tolerably narrow ravine. These two or branches of the main East and West Chain, die out k down to the general level of the country about a mile of the range line, between ranges 2 and 3, so that the road Fayetteville to Childersburg, whilst it crosses this moun-us country, appears to be nearly level all the way. To-s the western extremities of the spurs above mentioned, cross ridges are quite numerous. These are frequently along the Kahatchee creek, and they are composed y of semi-metamorphic (talcoid) slates, often inclosing ular lumps of quartz. In two or three places I ob-d the strike of north 10 degrees west, and a steep dip to orth-east. The Fayetteville and Childersburg road lies ipally over Quebec Dolomite, which, as I have said , fills in the spaces between the main elevations of Pots-Sandstone. West of this road, may be seen another derable range of hills, extending from just south of the h of Kahatchee, and approximately parallel with the e of the Coosa river, southward to the hills or moun-which surround the Sulphur Springs.

is is not a continuous chain, but a series of high points nating with lower places. Cedar creek cuts through it. s northern extremity, just south of Coosa bridge, in sec-

tion 3, township 21, range 2, east, it has an elevation of s
375 feet. This mountain, like the others, is compose
massive sandstone, and these were so much broken u
joints that I could not be certain of the dip ; the stri
probably that of the axis of the ridge. Upon descen
this ridge towards the east, *i. e.*, towards the Fayetteville
Childersburg road, a narrow belt of unchanged Qu
Shales, with the usual bright and agreeable colors, is cro
and then the dolomite of the low grounds. Further s
than the point where I visited this hill, the magnetite-be
sandstone has been found in abundance.

In the dolomite which fills in the spaces between the s
and ridges above named of the Potsdam Sandstone, is al
found more or less of good limonite. The localities whe
occurs in large quantities are numerous. At Fayett
Cedar creek flows over great masses of gray Cherty Dol
of the Quebec Group, and close to the ford, a little rid
half metamorphosed slates, juts up very abruptly throug
dolomite. North of Fayetteville, a similar ridge of slat
crossed, then another expanse of dolomite, after which
the hills proper, which, as I have already noticed, are a
crossing of the road, not much elevated. These hills
chiefly of sandstone, as I interpret it, of the Potsdam
but where the road crosses Kahatchee creek, a ridge or
of semi-metamorphic slates comes down nearly to the wa
edge, so that the road has to be cut out for some distan

The geological position of these slates, I am unab
give with certainty. They are of the same nature with
of the slates of the Acadian Group ; perhaps not, altog
so much metamorphosed, and a little more sandy. So
them may be Acadian, though others, from their pos
should be altered Quebec Shales, or, perhaps, Calcifero
Knox Sandstone. It will require much time and careful
servation to settle many geological questions presente
these hills.

The region just described embraces the Kahatchee
proper, but there is a part of the county south and s
west, so intimately connected with them in the folding

bances of the strata to which they owe their origin, hey will be considered together.

thward from the Plank Road Gap, towards Syllacauga ne Sulphur Springs, the road is a remarkably good one, over Quebec Dolomite, which is tolerably free from the ridges which characterize portions of it.

r the edge of the Acadian slates, from Vincent's mill to auga, and beyond that to Gantt's quarry, a bed of crys- white marble is found. In a well at Mr. Hubbard's, lacauga, the marble lies at a depth of twenty-eight feet he surface. In section 21, township 21, range 4, east, . Fluker's, on or near the summit of a low hill is a m, about ten feet thick, of calcite, enclosed between beds of quartzite, all striking north-west and south- nd dipping north-east. The calcite is well crystallized reaks readily into cleavage fragments of large size. ontinuation of this bed north-west, only ten feet distant, simply a stratum of very pure blue limestone. South , about twenty yards, another exposure of light gray one is seen, and in a well almost in the continuation of ike of the calcite stratum, very good marble has been d, whilst north of the same another exposure of fine- d, almost crystalline limestone.

hill thus appears to be made up of a succession of f quartzite and limestone, hardened and crystallized tamorphic action. The change in the texture of the ratum described, from compact, to crystallized, within stance of a few feet, is noteworthy.

position of these beds, less than a mile from the east est ridge of Potsdam Sandstone, and within two miles termination of the same towards the east, may have significance. Along the southern face of the latter of Potsdam rocks, and in the valleys skirting the foot hills, are several localities of slates which have been l to some extent in the hope that they might prove to d roofing slates.

th-west from Oden's mill, in section 22, township 21, 3, east, are outcroppings of such slates quite fissile and

smooth-faced. The color is a light gray or drab. Dolo
or limestone is found in close proximity with these slates,
if their relative positions are not disturbed by faulting
limestone is *under* the slates. Further south-west the
slates show still better, and they are generally not far fr
yellowish fine-grained and tolerably soft sandstone, w
was used by Col. Hill during the war for making grindst
This sandstone seems to lie under the slates also.

West of this, in section 21, are several quarries from w
large quantities of slate were dug, and, I believe, shippe
the market. The slates are quite fine-grained and fissile
beds strike north-east and south-west, and dip 6 to 10 de
south-east. They are traversed by two sets of joints,
running north-north-east and south-south-east; the
east-north-east, and west-south-west, dividing the slates
rhomboidal blocks, which are some twelve to eighteen in
in dimensions. Going south from the slate quarries we
the ridge of sandstone which furnished material for the g
stones alluded to above, and as the dip of the strata is s
east the sandstone is *above* this belt of slates, though ap
ently below that spoken of in section 22. A very short
tance south of the sandstone ridge, in section 26, townshi
range 3, east, a tolerably good section of the rocks, is exp
which I give, in *descending* order:

1. Bluish, curly, arenacious slate.... ....3 to 4
2. Dark blue, flinty limestone, much hacked on weathered surface, tolerably massive........ 15
3. Shaly, black limestone......................5 to 6
4. Compact, white flint, slaty below............. 4
5. Light gray, flinty limestone or dolomite of undeterm thickness.
6. Below this, to the bottom of the hill, fragments of metamorphic slates, somewhat sandy.

The dark shaly limestone is fossiliferous, but no f
were determinable.

From a stratum on a hillside, on the opposite side o
road from where this section was taken, very good limes
for lime burning, has been obtained.

ilst the geological equivalency of the slates and sand-
s, and of the strata of the section above are not per-
clear, yet I am strongly inclined to the opinion that
belong to the Calciferous or Knox Sandstone, and Que-
hales. The limestone and slates, with a heavy bed of
tone between, are probably of Calciferous Age, Knox
stone, whilst the limestones, semi-metamorphic slates,
f the above section, are more probably of the Quebec
.

ar Dr. Hill's residence a stratum of fine grained black
tone, with veins of calcite, which receives a handsome
and is a fine black marble, has been utilized to some
t, and table tops, mantles, and other articles of a similar
e, made from it, are very beautiful.

ith of Dr. Hill's, in section 2, township 22, range 3, east,
ntt's quarry, where so much of the beautiful marble of
dega has been obtained. The property is at present
idle.

I remarked above, this belt of marble will probably be
to be Quebec Dolomite, metamorphosed. Its position,
he associated minerals, chiefly talc and other magnesian
tes, all point to this view. Towards the south-west, the
le has been found and worked at Mr. Cooper's (sec-
12, township 24, range 16, east, of the lower survey,) in
county. At this place, also, it lies at the edge of the
of Acadian slates, and shows the usual varieties, white,
and banded.

Syllacauga, which is finely located on high ground, with
d view of the Metamorphic mountains towards the east,
uebec Dolomite, the country rock, is charged with iron,
ragments and masses of limonite are found everywhere.
of these occurrences were interesting, since they were
lefined pseudomorphs of limonite after pyrite. The
alline form is usually the cube, without modifying planes.
of these cubes, when broken open, show a nucleus of
anged pyrite. Mr. Gothard's, just east of Syllacauga, is
ality from which many were obtained.

ar Mr. Simon Morris' are great quantities of brown ore,

quite sandy, however, upon the surface. No explorations h
been made to test the quality of the ore below.

A few miles north of Syllacauga, near the base of the m
tain with its magnetite-bearing sandstone, beds of limonite
found in sections 16 and 20, the latter on land belongin
Mr. J. K. Oden.

Going south-west from Syllacauga, the road is over the
lomite, which is highly ferruginous, and surface specimen
limonite abound everywhere.

At Mr. Averitt's, about section 5 or 6, township 22, ran
east, there is a very extensive exposure of Quebec Dolo
from under ledges of which boils up a magnificent spring

The dolomite is gray, sandy, presenting a hacked app
ance upon weathered surfaces. It is the characteristic
mite of this age.

South-west from Averitt's, rise the mountains which
round the Sulphur Springs, and make such an attractive
ture of the landscape.

These mountains have already been referred to, incide
ly, as forming the continuation, south of Cedar creek, of a r
of Potsdam Sandstone running south from near Coosa Br
and approximately parallel with the river. The road
Fayetteville to the Springs, after passing for some dis
over the red clay soil of the Quebec Dolomite, leads thr
a very low gap in this mountain, hardly raised above the
eral level of the country. South of this road the mou
has a course first south for a mile or more, then curves ar
gradually towards the south-west, having nearly that dire
where it forms such a grand back-ground to the scene
the Springs.

The following section of the rocks composing the mou
south of the springs may serve to give an idea of its s
ture: "The springs are situated in a valley closed in on
sides by hills. On the south and east the hills are high
precipitous on the side overlooking the spring."

A little branch flows down towards the north-west from
tween these two hills, and at the Springs it passes over ledg
dolomite, and it is from between the strata of this rock

waters of the Sulphur Spring seem to rise. It may be, ever, that they owe their content of sulphur to the Black le, for a stratum which has all the characteristics of the e, with its kidneys of iron pyrites, makes its appearance ne base of the mountain, a few miles north of the Springs.
ascending the hill south of the Springs, there is first a le slope of several hundred yards over ground covered fragments of a hard slaty sandstone, almost quartz st, of grayish and white color. Then begins a sharp as- of about forty-five degrees over fragments of the same, to the summit, about 300 feet above the Springs.
he summit of the mountain is composed of heavy-bedded lstones, almost quartzite, striking north-east, and dipping h-east, at an angle of about fifteen degrees. The sand- e, as is usual with massive rocks, is intersected by joints, section of which has the direction of the strike, and being ight angles to the bedding planes, forms the bold cliffs ch overlook the valley of the Springs.
crossing to the south side of this mountain through a or low place east of the Springs, after passing sandstones bove described in the lower part, we find sandy, half-met- rphosed slates above, on the southern slope of the moun- . From these slates, a few miles towards the north-east, s a chalybeate spring which is much visited. Succeeding slates towards the south, are strata of the Quebec Dolomite, after crossing a narrow valley of it the Acadian slates are hed, with the belt of crystalline marble at the foot, as is the all along the line of junction of the two formations towards north-east. At Looney's Mill, on the opposite side of the ntain from the Springs, and at its base, the slates (semi- amorphic) of the upper part of the mountain are exposed onsiderable thickness.
rof. Tuomey, in speaking of this locality, considers the ntain and its slates to be Sub-Silurian. Following him, ve the same classification in my Report of 1874.
fore extended observations, however, and the great simi- ty between these sandstones and slates, and those of the hatchee Hills, incline me to the belief that the mountain

is composed chiefly of Potsdam Sandstone, here very d
and compact, whilst the semi-metamorphic slates on the fl
are changed Calciferous or Knox Sandstone or Quebec Sh
The absence of all fossils, however, will cause some doub
rest upon this matter, since even partially metamorph
rocks are not always easily referred to their unaltered p
types.

It remains now only to speak of the tract of country l
north of the Kahatchee Hills, and between the Pope M
tain and the East and West Range, as we have designate
The greater part of this area as far as Alpine—perhaps
whole of it—is occupied by strata of Quebec Dolomite, so
times with cherty soils supporting a growth of pines, so
times more calcareous, and then forming good farming la
Limonite is of frequent occurrence. At Mr. John Od
residence, S. 13, T. 21, R. 3, east, there is quite an exten
bank of it, partly cherty, but chiefly of good quality so fa
the superficial appearance goes. This is very near the
of the Savannah and Memphis Rail Road, and I doubt
will one day be utilized.

Not far from Mr. Crumpler's house, in S. 5, T. 21, R. 3
there is an extensive outcrop of limestone, the property of
John Oden. It is a blue argillaceous banded limestone chi
but part of it is much purer. It strikes N. 10 deg. W.,
dips about 85 deg. NE. The strike is approximately par
with that of a ridge of Potsdam Sandstone in the immed
vicinity, but the dip is just the reverse of the dip of the st
of the mountain. These limestones have a good deal the
pearance of some of the strata of chazy limestone seen
Shelby and Bibb.

Another quarry in S. 32, T. 20, R. 3, east, shows a sim
series of rocks, with some bands of black velvety hornst

Lime has been burned from the stone of these quar
and where properly selected a good article can be obtai
These localities are also near the rail road line mentioned

CALHOUN COUNTY.

Topography.

e portion of this county examined during the past sea-
mbraces only its southern part, below Jacksonville; a
part east of the S., R. & D. R. R., from Oxford to Da-
vn and northward to White Plains; and west of the
oad, a portion of the county from ten to fifteen miles
the Coosa river. It will thus be seen, that the present
t is only a partial one, whilst it embraces probably
of the geological formations found within the county.
e drainage of Calhoun county is all into the Coosa
but in two directions; the one and principal direction
southward and westward, the former through a part of
dega county; whilst the other is northward, through
of Cherokee county.
order to present these two systems of drainage clearly
e the reader, it will be necessary to refer to what has
said above in the geology of Talladega, and also to an-
te a little of what is to follow.
will be remembered that the Potsdam chain, west of
dega town, was said to die out towards the north-east
e reaching Choccolocco creek. The chain is resumed
a few miles north-east of Choccolocco, and runs then
ut serious interruption northward, and north-eastward
Cherokee. The break in this chain in the southern part
county determines the direction of the principal system
ainage for the Choccolocco, rising up in the north-east
r of the county at the foot of the quartzite ridge, which
s the eastern limit of Acadian slates, soon emerges from
into the Quebec Dolomite, and flows south-westward
s formation between the Potsdam Sandstone mountain
e west, and the hills of Acadian slates on the east, to

very near the southern boundary of the county, there tu
almost westward, or a little south of west, and flows into
Coosa through the gap caused by the interruption in
Potsdam Chain.

As it turns abruptly westward it receives several tribu
ries from the south from the hills of Acadian slates, in C
burne and Talladega counties. The largest of these tribu
ries are Hatchessofka, Wolfscull, Salt creek, and Cheah
It is seen, therefore, that the northern part of Talladega
drained off northward through this gap, whilst the mid
and southern portions are drained through the other g
which is found between Alpine and Childersburg.

The creeks which flow westward are shed by the Potsd
Chain, and the latter having more a south-westerly tha
westerly course.

Nance's creek, a branch of Terrapin, rises also in
north-eastern part of the county, between the Potsdam Cl
and the Acadian slates, thus almost overlapping with Cho
locco, flows, unlike Choccolocco, northward around the up
end of the Potsdam Chain, into the Coosa.

It can not fail to strike the most superficial observer,
the mountains of Potsdam Sandstone in this county and
ladega, have been all-important in determining the direc
of the principal streams, and if, as there is good reaso
suppose, the quartzite ridge, so often alluded to as forn
the eastern boundary of the Acadian slates, be also Pots
Sandstone metamorphosed, the importance of this forma
as a watershed is all the more apparent, for only Tallad
creek cuts through it, in Alabama, at least south of Chero
county.

From what I have said above concerning the drainage,
general topography of the county will be easily underst
The highest points are probably along the quartzite r
which is the dividing line between Calhoun and Clebu
West of this are subordinate hills of slates, and then a r
country of Quebec Dolomite. Succeeding this, towards
west, is the chain of Potsdam Sandstone, peaks of which
abruptly 1225 feet or more above the level of the Dolon

estward thence to the Coosa, is a broken country of Quebec lomite and its cherty ridges, with less important belts of ier formations, which need not be here further particu- ized.

GEOLOGY.

e formations which have been identified in Calhoun are—

. Acadian—slates and conglomerates.
. Potsdam—sandstones and shales.
. Calciferous Sandstone. (Knox Sandstone.)
. Quebec Shale. (Knox Shale.)
. Quebec Dolomite. (Knox Dolomite.)
. Chazy.
. Cincinnati Group.

1. ACADIAN.

The rocks of this group in Calhoun county have not been died, except in crossing them from Davistown towards ss' Ford on the Tallapoosa. There is very little to be added what I have said of these rocks in Talladega, and in cross- them at this gap, the section exposed is far less complete d satisfactory than that on Talladega creek.

2. POTSDAM.

The rocks of this formation are sandstones, coarse and fine ined, (the former sometimes passing into a conglomerate,) d sandy shales. The latter less abundant and character- ic than the sandstones.

The sandy rods, formed by filling in of the burrows of *Sco- hus*, are abundant in every outcrop of the Potsdam sand- ne visited in this county.

The mountains seen west of the S., R. & D. R. R., from the abama Furnace to Oxford, and east of the rail road from ere beyond Jacksonville, are composed of this sandstone.

East of the main chain, several subordinate ridges and obs of the same rock occur, which will be noticed below.

DETAILS.

From the Alabama Furnace in the northern part of Talla-

dega county, a tolerably high and isolated mountain may
seen towards the north and north-east. It begins about
20 and 29, T. 16, R. 7, E., and trends nearly due east to
ford, where it ends abruptly.

A short distance from the end of this mountain, begins
other of the same rock, and through the gap thus formed
rail road passes from the eastern and southern, to the north
and western side of the Potsdam chain.

The short mountain, about six miles long, first mentio
has the local name of Coldwater mountain. Its highest p
about S. 28, T. 16, R. 7, E., is 1025 feet above the rail roa
the Furnace. The eastern or southern flanks of the mo
tain show a narrow belt of reddish and chocolate colo
shales of the Quebec Group, and probably Calciferous
Knox Sandstone would be identified upon closer examinat

The summit of the Coldwater Mountain is covered
huge masses of sandstone, many filled with *scolithus rods*,
otherwise the counterpart of what were seen on the top
the peak at Alpine, and elsewhere on the southern prolo
tion of this chain. The strike nearly east and west, and
south.

In several places on this mountain I noticed large accu
lations of irregular concretionary masses of brownish che

On the southern face of the mountain about section 28,
near by, on the northern side, separated by a narrow com
ridge of sandstone, are two immense funnel-shaped depr
ions in the sandstone, from two to three hundred feet d
and several hundred yards across from rim to rim. The s
of these funels are almost precipitous, some parts being
pendicular cliffs formed by the broken faces of sandstone

These funnels are not gapped on any side. In the south
one a stream of water is said to fall, and disappear thro
the crevices at the bottom; at any rate it does not cut thro
the rim in any place. The northern funnel has no run
water in it, nor is there any accumulation of water at the
tom. I did not descend into either, on account of the
ness of the hour at the time of my visit, and the time ne
sary to descend and climb out. From the edge of the d

ridge where both of these depressions can be overlooked, r unbroken rims can plainly be seen. Upon the inner es are growing the large forest trees of the mountain.

t the western extremity of this mountain in the Quebec omite, a large area covered with bold springs supplies a t volume of water for a short creek, the Coldwater, which s into Choccolocco three miles from its source. The west- extremity of the mountain widens out into several short rs, and at the eastern end at Oxford, also, the mountain is a single ridge, but divided. At the latter place the sand- e is literally filled with *scolithus rods*, and the little round ts which mark the cross sections of these rods on the bed- planes of the sandstone.

ust across the rail road at Oxford, nearly opposite the end he Coldwater Mountain, begins the Ladiga or Choccolocco ntain, as it is called, which continues on beyond Jackson- . Except at the southern extremity, this is likewise not ngle ridge, but rather an aggregation of ridges, the exact cture of which has not been fully made out. Between the ngs or fingers of mountain thus caused, are elevated coves, ch, near Oxford, are the repositories of some of the best he limonites which supply the Woodstock Furnace, and which more will be said below at the proper place.

now's branch, a small stream which rises north of this sdam ridge, instead of flowing around the end of the e cuts through it just in the edge of the town of Oxford, lays bare a very good section of the constituent rocks of ridge. These are heavy-bedded solid sandstones chiefly, some sandy shales on the south-eastern flank. One tum of the sandstone is peculiar from the specks of hydra- ferric oxide, which give to it the mottled appearance of nite. On the south-eastern flanks the brownish sandy les, though probably belonging to this formation, may be- to a higher group. Succeeding these, south-east, comes Quebec Dolomite, which prevails, with few interruptions, he hills of Acadian slates.

Vhere Snow's branch has cut through the last heavy bed sandstone of the mountain towards the south-east, there

is a bed of brown iron ore in irregularly shaped lumps, wh
when broken open, show an unchanged kernel of p
within, and every step of the progressive change from p
to limonite may be observed on a hand specimen.
lumps have all the irregularity, pitted surfaces, &c., of
limonite of the ore banks, and the *possibility* of a similar
gin for some of the ore is thus beyond doubt.

The sandstone of the ridge, where cut by Snow's bra
dips south-east and strikes north-east, the direction of
ridge at that place. Further north-east, however, the m
tain bends around, taking nearly a northern course, whic
holds beyond Jacksonville.

Some six or eight miles north-east of Oxford, one of
high points of this mountain has an altitude above the
road of 1,225 to 1,250 feet, and, as Oxford is 678 feet a
tide-water, of 1,903 to 1,938 feet above the sea. (The el
tion of Oxford is from the surveys of the Selma, Rome &
ton Rail Road.)

In riding along the summit near this peak, I noticed
same alternations of compact sandstone and sandy sh
making higher and lower points, as has been described a
on Crumpler's Peak in the Kahatchee Hills. A further p
of resemblance between the two places may also be cite
the occurrence of a depression upon the summit here
which water stands during most seasons of the year,
pond above Oxford being at least 1,100 feet above the
road.

The complex structure of the mountain is shown by
spurs which curve out from the main direction of the c
and enclose huge mountain amphitheatres, with almost
cipitous sides, which are covered with loose fragments of
sandstone. The difficulty of descending the steep side
one of these mountains enclosing a cove, is very great
some points insurmountable. One of the amphithea
spoken of holds parts of sections 25, 26, 35 and 36, to
ship 15, range 8, east.

Near Mr. Thomas P. Renfro's, section 26, township
range 8, east, there is exposed a great thickness of tough

ained black slates. They have the appearance in the quarry good roofing slates; but I do not know that any have been cavated which are fissile enough for that purpose. These ay be Acadian slates brought up in the up-heaval of the otsdam Sandstone, and such seems most probably their ue age, though their exact relations were not completely aced out. From the cove in which they occur one of the ibutaries of Cane creek takes its rise, and a short distance low the slates, down the branch, very good and pure limeone is found, (apparently Chazy, though possibly Quebec,) o fossils were observed.

Crossing the mountain again from White Plains over to cksonville, the same rocks are observed. The mountain is ere several miles wide, and not a single ridge. Beyond cksonville, I have not as yet made any observations.

I have yet to speak of occurrences of the rocks of this age etween the main ridge and the Acadian hills. In going om Oxford north-east to Davistown, just before crossing hoccolocco at Morris' mill, one of these ridges is passed, nd beyond it at the mill, outcrops of Calciferous or Knox andstone and accompanying shales, succeeded by Quebec olomite. Then another Potsdam ridge, and another, three all, between Oxford and Davistown, section 11, township 16, range 9, east.

Going north from Davistown to White Plains, the same ccession may be observed, three being passed between avistown and Capt. W. R. Hanna's residence. Then two iles north of Hanna's another, and at Mr. Charles Martin's ill another, which at that place is cut by Choccolocco creek. hese little ridges are not so much continuous ridges as lines f rounded knobs with lower places between. On the southast flank of each was noticed a belt of Quebec Shales passng upwards into the Dolomite, which with its cherty ridges nd accumulations of limonite, forms most of the Choccoocco valley. The strike of the Potsdam ridges appeared to e more towards the north-east than that of the main ridge, hich is nearly north and south. I give these few notes imply as matters of interest, for the only observations I have

been able to make, were during a hurried drive through
region in question. A more detailed survey of this pa
the county will be made, I trust, at no very distant day.

3. Calciferous or Knox Sandstone.

Mention has been made of occurrences of the rocks of
Group, incidentally in the preceding section. At Mc
mill it is seen in a small ridge where it has been quarrie
some extent to furnish material for building the dam and
pillars at the mill. The usual characteristics of the rock
seen there. This sandstone may reasonably be looked f
the south-eastern faces of the little ridges of Potsdam S
stone, which were mentioned near the close of the prece
section.

Three miles west of Jacksonville may be seen a sh
crested ridge. This is composed of Calciferous Sands
striking north-east and south-west and dipping south-
and on the eastern flank is a belt of Quebec or Knox Sh

The sandstones are of the usual agreeable colors, and
bedding planes are smooth, and marked with fucoidal
pressions and ripple marks. How far this ridge conti
north and south is not yet accurately made out.

I have information of the occurrence of rocks of this
in other parts of the county further west, viz., the con
ation of the ridge which makes the Jackson shoals on C
colocco, and on the eastern limit of the Coosa coal fi
but these two belts I have not personally observed.

Of useful materials from this horizon in Calhoun, I
none to record, except that the sandstones are occasion
used for building purposes.

4. Quebec or Knox Shale.

A narrow belt of these shales is commonly found on
eastern flanks of the Potsdam Sandstone ridges, and ri
of Calciferous Sandstone. I have noticed them on the so
ern face of Coldwater mountain, and also in the eastern D
mite belt between the Potsdam chain and the Acadian sl

ver the subordinate ridges of Potsdam Sandstone ap-

in, west of Jacksonville, a very plainly marked belt of
ec Shales is crossed just before reaching the ridge of
erous Sandstone, to which allusion was made in the
n above.
formation contains no materials of economic value
am aware of in this county.

5. QUEBEC OR KNOX DOLOMITE.

was the case in Talladega county, so here, the greater
of Calhoun county is Quebec Dolomite. It is found in
reas separated by the chain of Potsdam Sandstone.
western belt, I have examined only along one route.
onville is situated upon this formation near where the
am Sandstone has been brought up by faulting, to its
Near Jacksonville the formation is rich in ore depos-
t these remain yet to be examined. Westward from
own one passes from the Dolomite in to the Knox Shale,
Knox Sandstone some three miles distant, and crossing
ne of a fault, comes into a belt of Cincinnati Shales, and
le, and thence into the Dolomite once more, which pre-
as far as I have gone in that direction, about six or eight

section 36, township 13, range 7, east, a magnificent
g bursts out from the side of a hill where an embank-
has been made in times past for some rail road. In
n 1, township 14, range 7, east, on the property of Mr.
nk, there is a strong sulphur spring near the banks of a
stream. The spring appears to come up from strata of
ec Dolomite, which make the surrounding country. In
icinity is the old Draper lead mine, where galena has
found impregnating a limestone. Notwithstanding the
hat this occurrence of lead has been known for years, a
g vein of the ore has not yet been brought to light.
is near the upper part of the Dolomite where it passes
the Chazy or some higher group, and I am not sure that

the lead-bearing limestone belongs to this formation, th
such is most probably the case.

From Alexandria south-westward, towards Talladega
way is chiefly over the Dolomite. At Alexandria there
strong indications of iron in the color of the soil, and
fragments of limonite to be seen by the roadside, and
miles from the town is a great accumulation of the ore.

On Cane creek, not far west of Martin's cross roads,
tion 7, township 15, range 7, east,) the ore banks have
worked to furnish material for a Catalan Forge in the
time. From one of the old pits formed by the remov
the ore, rises a Chalybeate spring.

Six miles west of the Cross Roads, on Cane creek, the
also a sulphur spring, which I have not yet visited.

At Morris' mills, on Cane creek, a mile or two south o
Cross Roads, there is exposed a very good section of c
dolomite principally, striking north-east and south-west
dipping south-east.

From this point south-westward for ten miles, to nea
Dill's, section 16, township 16, range 6, east, just in the ed
Talladega county, there is an unbroken stretch of b
piney woods country, with hills of chert, in all respect
counterpart of the country crossed in going from Talla
to Collins' Ferry. A mile from Mr. Dill's the strongly f
ginous clay soil sets in once more, the country is more fe
and the limonite pebbles become more and more abund

At the western extremity of the Cold Water mou
boils up a wonderful spring, or series of springs, which
such a volume of clear water into the Choccolocco b
short, three miles long, Cold Water creek.

In the vicinity of Oxford, this western belt of Dol
seems particularly rich in ore, and all the little strips of
mite, which run up between the spurs of the Potsdam
stone, above Anniston, are charged with this ore.

Of the details of these ore banks, more will be found
low in an appropriate section.

On the eastern side of the mountain the Dolomite, wi
cherty ridges and beds of limonite, covers the country t

metamorphic slate hills of the Acadian Group. Inter-
ons in the continuity of this Dolomite belt, by ridges of
am Sandstones, with their linings of Knox Sandstone,
uebec Shales, have already been noticed.

the spaces between these ridges are occupied by the
nite, and it is not an unusual sight to find large accu-
ions of brown iron ore on the flanks of a ridge of Pots-
Sandstone.

e springs abound in this, as in all other areas of the
nite. A few miles east of Oxford the Boiling Spring
ng been known.

Capt. W. R. Hanna's is another noted spring, section 26,
hip 15, range 9, east.

Dolomite of this belt has been used without much sat-
on in the Woodstock furnace as a flux. A quarry near
nows, section 20, township 16, range 8, east, has been
d for that purpose. Analyses of this rock and of one
he Boiling Spring, given in Prof. Tuomey's Second Re-
show that these are true Dolomites, or magnesian car-
es of lime, with, however, from ten to twelve per cent of
Strata pure enough for lime burning occur in many
s.

Useful Minerals, &c.

ores of iron occurring with the Dolomite make this
ost important formation of the State from an economical
of view.

ore banks I can mention only a few of those which have
utilized, or those whose great extent deserve some par-
r notice. Allusion was made above to the ore banks on
creek, not far from the Coosa, which supplied a Catalan
One of the longest known, and perhaps most exten-
bank, or series of banks, in Calhoun is in the vicinity of
d. This flourishing town is partly in section 20, and
in section 30, of township 16, range 8, east, and is in
ap between two ridges of Potsdam Sandstone. The low
between these ridges is occupied by the Quebec Dolo-
which, every where in the vicinity of Oxford, is highly
ginous.

On the north side of the Oxford end of Coldwater Mou tain, ore banks of considerable extent are worked at pres by Dr. Snow, and the ore sent to the Woodstock Furna Between Oxford and the furnace, in the little strips of l land running up between the spurs of Potsdam Sandsto are everywhere banks of ore, generally the property of in viduals. Many of these localities were particularly inve gated by Prof. Tuomey, and several analyses of these w published in his second report. I have as yet no new analy of ores from these places to add.

In S. 7, T. 16, R. 8, E., the Woodstock Furnace is situat about 300 hundred yards north of the old Oxford Furna which was destroyed during the war. The fields about furnace, east to the foot of the mountain, have been pre well worked over in excavating ore.

North-east of the furnace, a few miles distant, is a cove the Potsdam Sandstone, Rocky Hollow, whence comes a la part of the ore, and more particularly the manganiferous o which have of late been worked up in the furnace. In S. T. 15, R. 8, east, is one of the banks containing the mang ese ore. This ore is partly a black and brittle ore of ir with a large percentage of manganese, partly a soft bl earthy mass which rubs off on the fingers somewhat l graphite, and partly a fibrous limonite, sometimes pure, so times manganiferous.

As has been intimated, the company has recently made c siderable quantities of *spiegeleisen*, and I understand that rangements have been made for the production of this m for the market.

Near this section, 33, is another bank, with ordinary li nite. There is, however, scarcely a little cove between spurs of the mountain which has not furnished its quot ore to Woodstock, or to the old Oxford Furnace.

Over the mountain from Woodstock, on the south-east s there is another very extensive outcrop of limonite near M. Garrett's residence, S. 11, T. 16, R. 8, E.

Still further east, near the hills of Acadian slates, are ot great deposits of limonite. In the lower tier of section

ip 15, and the upper tier of township 16, range 9, east, re banks are found in close proximity to the detached of Potsdam Sandstone, to which allusion has been bove. Part of this ore is siliceous, and probably unfit lting, but the greater part is of exçellent appearance. localities are north and north-east of Davistown, and two miles of that town.

as noticed in Talladega county, so here, the larger de- of limonite seem to lie nearer the Acadian hills.

r details concerning the various occurrences of iron ore oun will be reserved for a future report.

IRON INDUSTRY OF CALHOUN COUNTY.

Woodstock Iron Works.

-office, Anniston, Calhoun county, Ala.; Selma, Rome lton Rail Road. A. L. Tyler, President; Sam'l Noble, ry and Treasurer.

furnace was put in blast April 13, 1873. One furnace high, 12 feet bosh; closed top. Capacity, 500 tons nth; all pig metal for car wheel and foundry purposes. ot and cold; can change on cold blast in a few min- Blowing cylinder 72 inches in diameter, 4 feet stroke. 30 inches cylinder, 4 feet stroke. Gases are usd for the boilers.

used, brown hematite; fuel, charcoal. Ores within ¼ the furnace, unlimited in extent. Limestone, 4 miles ; contains 99.24 Carbonate of Lime.

ND 7. CHAZY, TRENTON, AND CINCINNATI GROUPS.

e will be considered together, for the reason that suffi- ta have not yet been collected to separate them in the lities where I have noticed their occurrence in the

ion has been made above to the occurrence of shales Cincinnati Group, in going westward from Jacksonville.

After passing the sharp crested ridge of Calciferou
stone three miles west of Jacksonville, we come into a
yellowish calcareous shales, with which are associated
beds of highly fossillierous crystalline limestone or
These shales and marbles are the counterparts of the
and limestones of the Cincinnati Group, as exposed
opposite side of the river from Knoxville, Tenn. I ha
little doubt that they belong to the same group, tho
recognizable fossils could be detached from the lim
The lower part of these beds probably pass through the
into the Quebec Dolomite, which succeeds and makes
belt towards the west.

Although I detected no beds of undoubted Chazy lim
they will probably be found upon closer examination.
therefore, merely these notes.

At Aderhold's Mill in the NE. $\frac{1}{4}$ of S. 19, T. 14, R.
under the bridge a fine section of the shales of this g
exposed, and with them is associated a sandy ferrugin
careous rock, similar to Safford's Iron Limestone.

From this place, south-west to Alexandria, the r
wholly over these shales. At the latter town, or very
a belt of dolomite is entered, as has been indicated a

Metamorphic Region.

Wood's Copper Mine.

With a view to laying before my readers an accoun
operations at this mine, since the publication of my
port, a short trip was made to the locality during t
summer.

Mr. Wood has erected one calciner, with a capa
6,000 lbs. of ore in 24 hours; one reverberatory,
capacity of 1,200 lbs. of calcined ore in 24 hours.
two furnaces are calculated only to make a matte of
cent. There is also a crushing mill of four stamps,
engine of 30 horse power.

is in contemplation soon to put up two blast furnaces
a refiner, and to produce ingot copper on the spot.
e amount of ore now lying in piles about the mouths of
hafts, and of the refuse from the ores shipped last year,
imated to be about 800 tons. All this will do for smelt-
nd will probably average 8 to 10 per cent.
to date, (October 15, 1875,) Mr. Wood has raised and
ed about 1,500 tons of ore, averaging 15 per cent of
r, for which he has received $3.75 per unit of the per
ge.
the wild rumors about the large amounts of silver con-
l in the ores, are reduced to the simple fact that with
res, are found occasionally, masses of rock impregnated
ne extent with sphalerite or zinc blende, which shows a
of lead and silver when carefully tested. The amount
halerite is extremely small, and the silver or lead in it a
num.
was stated in my previous report, the vein is a bedded
with the richer black sulphuretted ores, (which are com-
y called black oxide,) lying between the "gossan" above,
he "mundic" or solid pyrites below. As yet, only about
ards of the vein have been mined, and only the richer
have been raised, except where the yellow sulphuret has
mined for smelting, within the past few months. There
been no exploration of the vein by which either the
ness of the mass of cupriferous pyrites under the black
r its depth is ascertained. It has been cut to a depth
enty feet and a width of ten feet through the solid
, without reaching the limit of the vein in any direction,
at the probable amount of these pyrites, which averages
9 per cent of copper, is very large. As far as the vein
een worked the higher grade ores have been taken out,
he great waste thus incurred has induced Mr. Wood to
de for the working up of all his material at the mine.
sides the cupriferous massive pyrites, a light colored tal-
slate, smooth and soapy to the touch, and impregnated
the black sulphide, is used (mixed with the yellow sul-
,) in smelting, but it fuses with difficulty. The average

per cent of copper in this is about 8, but frequently str
of black sulphide, several inches thick, are found in it.

To Mr. Wood and to Capt. Adolf Thies, I am indebte
much of the information given above, especially as reg
the quantity of ore raised, and the figures concerning
furnaces.

At my request, Prof. W. C. Stubbs, of the Agricultural
Mechanical College, has made several analyses of the
specimens of the ore from Wood's Mine.

It will be seen that they are all sulphuretted ores, tho
thin superficial coatings of the carbonate, &c., give to the
variegated appearance.

No. 1, marked *Azurite*, from the numerous crystals of
mineral, seen upon the specimen. With these were
crystals of *Chalcopyrite*, patches of *Malachite*, &c. Br
and porous, and easily crushed.

A partial analysis showed:

Copper (metallic)	10.62
Iron	23.10
Sulphur.	29.20
Insoluble matter	4.00

No. 2, marked Copper Ore (*Chalcopyrite.*) This sampl
principally the black ore, with crystals of chalcopyrite
seminated through it, giving it lines of easy fracture. Ha
than No. 1, and more compact.

Metallic copper	34.95
Iron	Not determined.
Sulphur.	14.90
Insoluble matter	7.30

No. 3, marked Copper Ore, (*Malachite.*) This sampl
very porous and consists chiefly of chalcopyrite, with de
its of the green carbonate on the edges and portions of
face:

Metallic copper	19.24
Iron	25.20
Sulphur	23.10
Insoluble matter	16.60

o. 4, marked Copper Ore, (Black Ore.) Sample porous
very brittle, but like the others, mixed with the other
pounds of copper.

Metallic copper	43.04
Iron	15.47
Sulphur	11.40
Insoluble matter	7.40

No. 5. Marked Cuprite.

impure porous specimen, containing much iron.

Metallic Copper	45.24
Iron	31.29
Sulphur, not determined	0.00
Insoluble Matter	4.20

ese are generally picked specimens, the mass of the ore
ging, according to recent assays by Capt. Thies, about
r cent copper. Upon the composition and mode of ori-
f these ores, see further, the Report of Progress for 1874,
the remarks of Prof. Stubbs, in the Chemical Report
7.

rth and north-east of Wood's Mine very numerous ex-
ions have been made by various parties in the search for
er. One mile from Wood's is the shaft sunk by Ex-Gov.
I. Smith, from which very fair specimens of the yellow
ide have been extracted. Analysis of a specimen from
mine was given in my report for last year. Since that
a new shaft has been sunk, machinery set up, and pre-
ions made for systematic working. We may reasonably
t that paying ore will soon be found in some of the lo-
es where it is so diligently sought.

thin two or three miles of Gov. Smith's shaft, many trial
s have been put down. Some of these I was able to visit,
vhilst in none has a paying ore of copper been found, in
al, chemical test shows the presence of some copper.
of these openings are in township 17 and Range 11, E.,
n sections 7, 17, 18, 19, 24, and 25. At Mr. M. J. White's,

at the mine of Messrs. Parr & Seymour, and of Mr. Dri
the rocks excavated show a reaction for copper. The
is probably the case at the other localities given, but
not speak of these from personal observation.

The history of most of these undertakings seems to be
stantially this: A company with limited means, or an ind
ual, sinks an expensive shaft through the hard rocks, do
water; by this time the means are so nearly exhausted t
suitable pump for draining the mine can not be purch
and so the enterprise is abandoned, to be renewed at
other locality with a similar result. The number of sha
this vicinity, sunk to the water, is truly wonderful.

If a tithe of the money spent upon such useless sh
had been employed in the purchase of a diamond dri
which the supposed copper veins could have been thoro
tested before the heavy expense of shafting had been
menced, many sore disappointments and heavy losses
have been spared.

As in Prof. Tuomey's time, so now, the "practical n
from Ducktown" seem to be the bane of the country,
leading men to embark their fortunes in ruinous copper
ing enterprises, in localities where there is geologicall
the slightest reason for expecting to find a vein of coppe

Under such guidance, I have seen men digging for c
in non-metamorphosed Knox Dolomite, a bed of lim
serving the purposes of the "gossan."

COOSA COUNTY.

In the vicinity of Goodwater Station on the Savan
Memphis R. R., there are several localities of conside
interest. A good deal of work has been done there in s
of copper, and whilst no paying ore has been extracted,
is a very distinct trace of copper to be found in some c
rocks.

In the village, a pit has been sunk some 28 or 30 feet
in a gray arenaceous schist with scales of graphite.

was mentioned in last year's report, as appearing near
Olive in Coosa county, and also at several localities north-
vard in Clay county, between Mr. Weathers' and Can-
hkee, and elsewhere.

ne country rock near the station is syenitic gneiss, which
me places is more nearly a hornblendic rock, with a con-
able admixture of talc, making what is known as Soap-
e, at Mr. Nicholson's, and at one or two cuts above Good-
r. This rock cuts very easily, is quite massive, and re-
les the soapstone of Tallapoosa county, except that it is
her and rather more gritty; still, it is an excellent rock
nany purposes.

S. 3, T. 24, R. 20, east, an excavation for copper has been
e by Ex-Gov. W. H. Smith & Co. on Mr. C. W. O'Neill's
. The rock here is a dark graphitic schist, with frequent
s of biotite, and also crystalline plates, from half an inch
i inch in diameter, of a green lamellar mineral, (probably
)

ne same rock occurs frequently north-east of this in Clay
ty, at Mr. Weathers', at Mr. George Hobbs', &c. Pyrite
so of frequent occurrence, both in irregular masses and
eets between the joints of the rock. Between some of
oints is found also a black soft pyritous mass, which re-
les, in general, the black ore of copper, but it shows no
of copper. Graphite is one of its constituents. As an
rescence or incrustation on some parts of the walls of the
, there is a soluble salt of iron, probably the sulphate,
h, when wet with water and placed upon the knife blade,
s it with copper.

ne rock itself shows very little, if any trace of copper.
same strata are likewise exposed in the rail road cut near
het creek.

S. 10, T. 24, R. 20, east, in an old field there are found
ty large masses of *magnetite* with very evident crystalline
s, and strong polarity. All the fragments are considerably
r worn, and are found scattered amongst water worn
tz pebbles, over a considerable area. In the rail road
on Wild Cat creek, a dark colored stratum of rock attracts

the needle very strongly, and as this is only a few hun
yards from the locality just mentioned, the source of the r
netite may possibly be found in this rock.

The line of the Savannah and Memphis Road has bee
chosen as to cross the mountains at a very low gap.
Rebecca mountain, which is represented on the map
taking a southern course a short distance south-east of
lacauga, really does take such a course, so far as its
heights are concerned, though it seems that the strata w
compose it continue on in a south-west course into Ch
county. In other words, where the rail road crosses
mountain, there is a low gap, caused apparently by den
tion only, as the strata have the normal strike. This
place in the mountains is by no means a level for the s
of little hills of denudation, just out from the main hei
on either side into the low valley, and the rail road h
cross all these, making it almost a continuous series of
and fillings from Goodwater to Syllacauga.

In these cuts, the strata exposed have undergone de
position to that extent, that they are in very few places
thing more than stratified clays with interbedded laye
quartz.

Within three or four miles of Goodwater, the rocks cu
much harder and less changed, but beyond, to Syllaca
the case is as represented above. I have often spoken
prominent ridge of Quartzite, which forms the highest c
of this mountain at the gap, this rock is considerably
down, but stills forms one of the highest of the points cr
by the road. The water courses west of this ridge flow
Tallasseehatchee into the Coosa; east of the ridge the
all tributary to Hatchet creek.

The rocks along the plank road, which crosses some
south of the rail road, are much firmer and less decomp
The highest point, where the plank road crosses the qua
ridge, is, however, not more than 300 feet by aneroid o
vations, above Syllacauga.

CHEMICAL REPORT.

in my last report, so in this, I have thought it desirable
resent in tables, for greater convenience, the various
yses which have been given in the body of the report
e.

ave again to acknowledge my indebtedness to Prof. W.
ubbs, of the Agricultural and Mechanical College, for
ind assistance which he has given me in this depart-
.

Mr. J. Blodge Britton, of the Iron Master's Labora-
I am also specially indebted for a number of analyses
on ores which he has free of charge made for the
y.

knowledgment has been made above to the liberality of
Walter Crafts, Superintendent of the Shelby Iron Works;
S. S. Glidden, of the Alabama Furnace, and of Mr. Jas.
nas, of the Eureka Furnace, for their kindness in per-
ng analyses made for them, but not yet published, to
ar in this report.

e analyses referred to have been made by competent
trustworthy chemists, and no apology is necessary for
shing them. To Mr. Crafts, especially, I owe a large
ber of analyses.

e coal analyses are chiefly from Mr. Rothwell, but due
owledgment is made in each case.

Analyses of Copper Ores from Wood's Copper Mi
Cleburne County, Ala.

Since nearly all these ores consist chiefly of iron, copp sulphur, and insoluble matter, a general method of analy was adopted, by which these substances only, were det mined. The specimens analyzed usually contained a sm quantity of that compound of copper to which the name h been given in the labels of the survey. But no specimen v homogenous in structure, many compounds of copper bei found in the same specimen. Hence we have sought o for the above named ingredients.

The method of analysis was substantially as follows: T finely pulverized mineral was dissolved in concentrated nit acid, with the aid of gentle heat. The solution, diluted w water, was separated from the unoxidized sulphur, and insoluble matter, which were then carefully weighed or well-dried and weighed filter, then ignited, and the amou of insoluble matter determined; the undissolved sulphur ing estimated by the difference.

From the filtered solution, that portion of the sulp which had been converted into sulphuric acid, was precipi ted by *baric chloride*, and estimated as *baric sulphate*. T copper was next precipitated by *hydrogen sulphide*, as *cu sulphide*, and thrown rapidly upon the filter, then dried, dissolved, together with the incinerated filter, in *aqua re* the sulphur, of pure yellow color, separating. The solut was next filtered, and the copper determined in the filtr as *cupric oxide*, by boiling with *potassic hydrate*, igniting weighing.

Wm. C. Stubbs

TABLE I. Copper Ores from Wood's Mine.

mber of Sample....	1.	2.	3.	4.	5.
er................	10.62	34.95	19.24	43.04	45.24
....	23.10	......	25.20	15.47	31.29
ıur	29.20	14.90	23.10	11.40	.....
uble Matter........	4.00	7.30	16.60	7.40	4.20

. 1. Marked Azurite.
2. " Chalcopyrite.
3. " Malachite.
4. " Black Ore.
5. " Cuprite.

is interesting to note that in those specimens showing arbonates—*i.e.*, No. 1 and No. 3—the percentage of cop- s small, whilst the black ore, (the great mass of the ore ct mined) No. 4, shows much more copper. No. 5 is sim- mass of black ore with a superficial coating of *cuprite*; t No. 2, Chalcopyrite, is also chiefly the black ore with opyrite crystals intermixed.

alcopyrite, or the yellow sulphide, as will be seen above e geological report, is the mundic or solid ore of the vein. erages some 10 per cent. copper. The black ore lying een this below, and the "gossan" above, is considered ally to be a decomposition product of the Chalcopyrite, ich, as may be seen in the table, the percentage of cop- increased.

e long exposure to the atmospheric agencies, necessary oduce the carbonates, appears to have the effect of re- g the percentage of copper, probably by leaching.

, also, Report of Progress for 1874.

E. A. S.

TAALE II. IRON ORES.

LIMONITES, OR BROWN HEMATITES.

NUMBERS	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Combined Water	10.49	7.41	12.44	12.72	8.54	10.49	11.19	11.27	11.98	9.25	3.80	......	11.86	11.52
Siliceous Matter	6.04	3.06	7.84	5.61	2.34	14.11	3.09	13.49	1.50	7.06	11.74	0.76	7.58	11.71
Sesquioxide of Iron	79.93	82.84	73.10	78.63	87.49	76.15	84.10	73.44	84.03	78.86	81.35	......	77.54	68.93
Alumina	1.43	0.35	1.47	1.36	0.27	2.65	0.27	1.03	0.20	2.37	1.50	......	2.07	3.59
Oxide of Manganese	0.92	0.95	3.36	0.11	0.12	0.41	Trace.	0.00	0.20	1.49	0.75	......	......	3.77
Lime	0.07	1.02	0.11	0.06	0.82	0.11	1.02	0.38	0.24	0.58	0.57	......	0.07	0.10
Magnesia	Trace.	0.19	0.12	0.10	0.33	0.07	0.08	0.08	Trace.	Trace.	0.12	......	0.03	0.05
Phosphoric Acid	1.01	0.55	1.35	1.30	Trace.	0.80	0.20	0.33	1.22	0.37	0.11	......	0.29	0.13
Sulphur	0.00	0.45	0.00	0.00	0.48	0.00	0.46	0.28	0.03	0.14	0.16	......	0.00	0.00
Undetermined, and Loss	.11	3.18	0.21	0.11	......	0.21	......	......	0.60	......	......	......	0.56	0.20
Total	100.00	100.00	100.00	100.00	100.39	100.00	100.41	100.30	100.00	100.12	100.19	......	100.00	100.00
Metallic Iron	56.10	57.91	51.96	55.05	61.27	50.07	58.89	51.43	58.82	55.20	56.19	56.74	54.28	48.25
Phosphorus	0.45	0.24	0.58	0.57	......	0.35	0.09	0.14	0.49	0.16	0.05	1.52	0.13	0.06

1. Limonite from Bank No. 1, Ashby Iron Company's land, Bibb county. Analyzed by J. B. Britton. *Average sample.*
2. Compact, liver brown, variety of ore, Ashby Iron Company's land, Bibb county. Analyzed by E. A. Smith.
3. Limonite from Bank No. 2, Ashby Iron Company's land, Bibb county. *Average sample.* Analyzed by J. B. Britton.
4. Limonite from Bank No. 3, Ashby Iron Company's land, Bibb county. *Average sample.* Analyzed by J. B. Britton.
5. Pipe ore, from Ashby Iron Company's land, Bibb county. Analyzed by E. A. Smith.
6. Limonite from Dr. Starr's, Bibb county. *Average sample.* Analyzed by J. B. Britton.
7. Radiately fibrous limonite; outer surface smooth, mamelonated, with reddish color; interior rough, more or less porous and ochreous, Shelby county, six or eight miles north-east of Montevallo. Analyzed by E. A. Smith.
8. Compact limonite, breaking with smooth conchoidal fracture, moderately brittle. Color of ore, light liver-brown; of powder, yellow; Shelby county, six or eight miles north-east of Montevallo. Analyzed by E. A. Smith.
9. Limonite; Shelby county, five miles north-east of Helena. Analyzed by E. A. Smith.
10. Limonite, from the Banks of the Shelby Iron Company. Analyzed by Prof. C. F. Chandler.
11. Roasted ore, from Banks of the Shelby Iron Company. Analyzed by Prof. C. F. Chandler.
12. Black iron ore, from Alpine mountain, Talladega county. Analyzed by J. B. Britton.
13. Average sample of ore from the Seay Bank, Talladega county. Analyzed by J. B. Britton.
14. Average sample of ore from the Irona Bank, Talladega county. Analyzed by Mr. J. B. Britton.

TABLE III. IRON ORES.

RED HEMATITES.

NUMBER.	1
Metallic Iron	49.08
Silica, &c	23.45
Sulphur	0.11
Phosphorus	0.34
Alumina, Lime, Magnesia, &c	5.58

No. 1. Red Hematite ore from the mountain near C
ana. Analyzed by Dr. C. F. Chandler.

No. 2. Red Hematite, also from the mountain near
biana. Analyzed by Mr. J. B. Britton.

Forged Iron, made from ore from the Irona Bank, T
County. Analyzed by J. B. Britton.

TABLE IV.

Metallic Iron	
Carbon	
Silicon	
Sulphur	
Phosphorus	
Manganese	
Undetermined and loss	
Total	

Furnace Scale, from the Stack of the Alabama Furn
ladega County. Analyzed by J. B. Britton.

TABLE V.

Silica	
Iron and Alumina	
Zinc Oxide, Cadmium Oxide,	
Graphite and undetermined	
Total	

Numbers	1	2	3	4	5	6	7	8	9	10	11
Carbonate of Lime	99.11	99.16	97.52	93.77	98.91	67.55	95.40	89.03	55.35	61.86	96.70
Carbonate of Magnesia	0.75	0.75	1.27	2.48	0.58	24.91	0.94	3.91	34.58	33.55	......
Iron and Alumina	0.13	Trace.	0.35	1.01	0.63	3.58	0.68	1.08	1.48	1.09	1.40
Siliceous Matter	0.39	0.15	0.78	2.09	1.08	3.46	2.25	4.88	7.75	2.86	2.50
Sulphur	0.00	0.00	0.00	0.16	0.05	0.02	Trace.	0.13	......	......	......
Phosphorus	0.00	0.00	Trace.	0.00	0.00	0.03	Trace.	0.00	......	......	......
Water, and Loss	......	......	0.08	0.36	0.00	0.45	0.73	0.84	0.84	0.64	......
Total	100.38	100.06	100.00	100.00	101.30	100.00	100.00	100.00	100.00	100.00	100.60

No. 1. Compact drab-colored limestone, showing occasional crystalline faces; breaking with splintery fracture. Shelby county, J. M. Reynolds' Quarry. Analyzed by E. A. Smith.

No. 2. Very fine grained to compact limestone, from same locality. Analyzed by E. A. Smith.

No. 3. Limestone from Mr. Jones' S. 28, T. 21, R. 2, W., Shelby county. Analyzed by Dr. C. F. Chandler.

No. 4. Limestone from Quarry of the Shelby Iron Company. Analyzed by J. B. Britton.

No. 5. Limestone from same Quarry. Analyzed by J. B. Britton.

No. 6. Seam from same Quarry, light-colored, granular. Analyzed by J. B. Britton.

No. 7. Dark-colored, compact seam from same Quarry. Analyzed by J. B. Britton.

No. 8. Limestone from Quarry on Selma, Rome & Dalton R. R., near Columbiana, Shelby county. Analyzed by Dr. C. F. Chandler.

No. 9. Limestone from Alabama Furnace Quarry, Talladega county. Analyzed by J. B. Britton.

No. 10. Another limestone from same locality. Analyzed by J. B. Britton.

No. 11. Limestone from Shelby Iron Company's Quarry. Analyzed by Prof. Stubbs.

TABLE VII. COALS.

	NUMBERS.													
	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.
Specific gravity	1.22	1.29	1.29	1.38	1.29	1.28	1.12	1.28	1.25	1.35	1.30	......	1.38	1.36
Moisture	1.66	1.58	1.91	1.93	2.05	2.13	2.54	1.78	2.14	2.13	1.34	0.30	0.50	0.12
Volatile Combustible Matter	33.28	32.60	32.65	32.84	33.47	30.86	29 44	30.60	31.92	27.03	28 96	31.36	28.24	26.11
Fixed Carbon	63.04	62.62	63.91	59.64	62.20	64.54	66.81	66.58	63.68	66.22	60.58	65.45	59.69	71.64
Ash	2.02	3.20	1.53	5.59	2.28	2.47	1.21	1.09	2.26	4.62	9.12	2.81	10.92	2.03
Total	100.	100.	100.	100.	100.	100.	100.	100.	100.	100.	100.	......	......	......
Sulphur as Sulphate	.097	.223	.071	1.001	.118	.320	.073	.085	......	.114	.090	0.08	0.64	0.10
Sulphur as Sulphuret of Iron	.428	.727	.559	2.779	.523	1.160	.455	.479	......	.388	0.730			
Sulphur in Coke	......	......	......	......	......	......	.214	.223	......	......	0.210			

Sample No. 1. From Cahaba Vein—Davis' Mine.
" 2. " " " Holt's Mine.
" 3. " Black Shale Vein—McGinnis.
" 4. " Moyle "
" 5. " Little Pittsburgh Vein.
" 6. " Conglomerate Vein.
" 7. " Helena "

Sample No. 10. From Montevallo Vein.
" 11. " Gould "
These were analyzed by R. P. Rothwell.
" 12. From Conglomerate or Beaver Dam Vein.
" 13. " Newcastle or Milner Vein.
Analyzed by Dr. Otto Werth.
" 14. "

THE COTTON WORM.

BY A. R. GROTE, A. M.

he present paper is preliminary to a more extended his- of the cotton worm (*aletia argillacea* of Hubner; *noctua* *ia* of Say,*) an insect, with whose ravages at least, the on planter is familiar.

ne cotton worm, in the form in which it eats the leaves of cotton plant, is the worm-like stage of the growth of a l moth, belonging to a group of which there are already 1,200 known North American species. The perfect in- belonging to this family are called popularly by the e of Violet-moths; with us, in the south, we apply to e and other smaller moths (although belonging to distinct ral families) the name "candle-flies," from their habit of ming to light in houses. Technically the family to which cotton worm belongs is called *Noctuæ*, or sometimes *Noc-* *e.*

ne cotton worm in its earliest stage is a fertilized egg, the uct of the union of the sexes of the moth. This egg is sited by the female moth on the leaf of the cotton plant. in this egg, which is so small as not to be readily per- d, the growth of the young "worm" rapidly proceeds, in a few days it is sufficiently grown to eat its way out gh the shell and commence a free existence as a "worm" rva. If we now examine this larva, we find that the is made up of successive rings. The first three of these or segments, behind the head, bear each a pair of horny ed legs, six in all, armed with bristles and terminating in

the Missouri Reports, and elsewhere, the name *anomis xylina*, just sug- by myself in 1864, is commonly used. I have recognized later, that er's name has priority.

a claw. If we compare the cotton worm at this stage, w the common rain or earth worm for instance, which we f in the ground, we see that it differs by possessing th jointed legs, although the bodies of the two animals are al in being made up of successive rounded rings or segmer They belong in fact to two different types of structure; cotton worm being an Arthropod or jointed-foot insect, a the rain worm belonging to the true footless worms or V mes. Counting backwards from the head, we find that on 6th, 7th, 8th, and 9th, segments of the body of the cott worm, there are pairs of short, fleshy projections, which not jointed, but are used by the cotton worm for progressi The pair on the 6th segment are not used, and there are pr jections of the skin on the 10th segment also, showing a d tribution of these fleshy processes or false legs along the li of the hinder part of the body, without reference to th usefulness to the animal, and in an imperfect condition development. The last segment of the body is provided wi a pair of these fleshy false legs for grasping the leaf a maintaining the position of the animal while feeding. Wh we come to examine the anterior end or head of the cott worm, we find it made up of a harder covering above a beneath pairs of jointed appendages, the most prominent which are the cutting jaws or maxillæ, which perform t office of supplying food by tearing off the leaf of the cott plant. These jointed appendages to the head, are similar structure to the jointed feet of the animal, though they ser a different purpose in its economy. They are here head orga So that we now see that there are three distinct regions the body in the cotton worm, characterized by three diffe ent kinds of appendages. These different regions are tec nically called head, thorax and abdomen. In walking, owi to the disuse of certain of the abdominal or fleshy false le the cotton worm doubles the body between the thorax, whi bears the true jointed legs, and the 7th abdominal segme This position of the body gives it the name of a half-loop As it grows, the yellowish-green cotton worm casts its sk from time to time, feeding all the while, and growing rapidl

egments of the body are seen to be ornamented with dots, which, under the microscope, appear as warts, of which give rise to hair. In some of the worms there istinct dorsal line visible, wanting in others. This stripe the back gives the worms a peculiar appearance; it to be a variation, the color due to the massing of pig- cells in the skin, and not a reflection of the digestive n of the animal, which commences at the mouth and at the last segment, through the opening of which the ood of the animal is expelled in little pellets. This va- n of the markings of the cotton worm is interesting, se it shows the worm to be undergoing some slow pro- f modification, and it may be that its present mode of the Southern States is producing some change in

Central Alabama, I have watched the growth of the s on the cotton plant. The worm appears there in cer- easons, as early as the latter part of June. After feed- r a period of about fourteen days, the cotton worms ence preparations for shedding their skin to pass into hrysalis stage of growth. For this they spin a few threads of silk on the plant itself, which they rarely e for that purpose. Within this light web the last larva s thrown off, and the brown chrysalis skin is exposed. is state the worm passes from a week to ten days. g this time, although appearing quiet outwardly, and ut exterior organs of locomotion, growth takes place the shell of the chrysalis. At last it has progressed that it arrives at maturity. Through an opening of ead and thorax at the back of the chrysalis, the full and perfectly developed cotton fly or moth appears, ngs merely little pads at the sides. These are quickly ded by a muscular action, and by a circulation in the of the wing, which ceases so soon as' the wings are in the sun. The body is now seen to be covered with ; the wings cover the body so much, that at first we t see that it is, after all, the same animal which we first as a larva. But the three portions of the body

may be seen. The head has two long jointed antennæ c feelers. The jointed maxillæ have become a spiral tongu The thorax supports its six legs as before, while the fleshy c false legs of the abdomen have disappeared, as being of n further service to the animal. The insect is now matur and in a condition to commence its work of propagating i young. Although the sexual organs are present in an unde deloped condition in the larva, this insect in that stage is i capable of reproduction. The sexes are separate, and a tru copulation takes place before the eggs of the female moth a fertilized, and their growth can commence.

A series of observations in Southern and Central Alabam has convinced me that the cotton worm is an imported insec and not indigenous to the Southern States. I had previousl published some observations on that point, and I submitte a summarized statement to the American Association for th advancement of science at Hartford, in August, 1874. Th cultivation of the cotton plant, upon which this insect feed is artificial. In our climate this plant has become an annua The first herald of the cotton worm I have found to b always the flight of the parent moths. These would come t light in houses, and in a few days thereafter I found th young worms on the plants. This, in Central Alabama, wa in June or July, and previovsly I had always heard of th appearance of the worm to the southward. Before it, th cotton in my vicinity had shown no sign of worm, and ha any existed in the country it must have showed itself durin the preceding three months, while the young cotton plan were growing. In favorable seasons the broods were succes ive until frost, and the death of the cotton plant. Whe food failed on one plantation the worms wandered to anothe but not till then. The first brood in one locality is irregula skipping some plantations, invading others. Again, I hav noticed that, while there was yet leaf enough left, and th season yet warm, whole sections would be forsaken by th freshly disclosed moths. There is no doubt on my min that the cotton worm has a yearly migration northward, fro the facts in the case. The cold weather finally kills th

, without their being able to provide for a further . I have noticed the moth in the Fall as far north as la and the great lakes and on the coast of Maine. Al- arriving there late in the season, it must perish ; there food for its progeny; it is too late for it to retrace its On this head I have already been able to contradict ablished statements of Prof. C. V. Riley, in the 2d and lissouri Reports, which, however, were not based on nal experiment. The reasoning there given with regard habits of the cotton worm, was entered into without alented observer having sufficient facts before him.

migrations of animals are among the most important nstances affecting the forms of life. Wallace and Wag- ave already shown how the separation, in this way, of races or varieties may have given rise to new species. is first to be considered, the involuntary migrations of ls by being floated down rivers, or conveyed by the As we study those which are provided with wings, voluntary migrations are seen to play an important part eir life. Birds and insects share these characters in on. Flights of the storm butterfly (*Danaus Plexippus*,) already been noticed crossing the great lakes in the and going southward as if to endeavour to hybernate in mer climate. This butterfly hybernates in Alabama. ts of butterflies have been frequently observed in re- as remote as the English Channel, and the Amazon The cotton worm moth is strong-winged and has a smoothly scaled body, offering very little resistance to ind. Although the wind may accelerate and assist its tions, I regard them as voluntary, from the facts of its ure and the wide territory which it covers. The cause northward migration of the cotton-worm moth from southern localities over the cotton belt, and as far north nada, cannot be suggested as yet, the data not being all n. One thing is clear, that the territory growing cot- ver which they pass, increases their numbers by pro- them with food, and thus makes them an enemy of the planter.

I have not had the opportunity of experimenting with a
of the preventatives or remedies against the cotton worm,
which I have seen public notices. Those in which Pa
Green enters the composition seem to have been most su
cessful, from their cheapness and poisonous effect. Care
the use of such material cannot be too strongly recor
mended. The metallic basis of Paris Green stays in the so
is washed into channels, or by infiltration may reach in
springs. It cannot be got rid of by evaporation. It is
poison to all animals.

I have suggested that, in order to act intelligently agair
the cotton worm, concerted action by the planters is nece
sary, and that the artificial agent used to destroy the cott
worm be employed against the first brood as it appears
any given locality to prevent its spreading further. I final
suggest that there be a thorough collecting of all facts co
cerning the worm in different portions of the State, and th
such data, revised by a competent scientist, be published l
State authority. A collection of all the facts relating to tl
insect, and other diseases of the cotton plant comes clear
as a duty, which an intelligent State should perform, whe
its interests are so largely engaged in the matter as are tho
of the State of Alabama.

APPENDIX A.

ol. Watrous, President of the Alabama Coal Mining Co.:

r—In reply to your note asking for information in rela- to that portion of the Cahaba Coal Field in which the of the Alabama Mining Company are situated, I have pleasure in sending you a brief report on the subject. report is derived from my published reports, and from esults of an exploration made during a short vacation last ner; and although the subject will be more fully pre- d in my forthcoming report to the Legislature, yet as deem it of importance to the interests of your enterprise, certainly is to those of the State, to make known as early as widely as possible the extent and value of our mineral sits, I most cheerfully give you such information as I ess on a subject in which, both from duty and inclination, e so deep an interest,

I am, sir, very respectfully yours,

M. Tuomey.

tober, 1855.

REPORT.

escription of the Eastern side of the Cahaba Coal Field.

e Cahaba Coal Field was first opened near its south- ern extremity, above Pratt's Ferry, and on the right bank e river. It was the intention of the company formed he purpose of exploring the coal found here, to use the as a means of transportation, but the well-known diffi- es attending the navigation of all our streams above the caused this enterprise to be abandoned; in the mean the extension of the Ala. and Tenn. R. R. R. to Monte- , soon directed attention to the eastern side of the field

as most likely to be first available, as the rail road wo
afford to the product of the mines an outlet always cert
and reliable, and moderate in cost of transportation. It
in this portion of the coal field that the property of your co
pany is situated.

It is an interesting fact that the Cahaba Coal Measures
not thin out gradually towards the edge of the field, but a
abruptly against the upturned Silurian rocks.

In the first examination of the Cahaba valley, west of
river, I pointed out the fact of the high inclination of the b
composing the coal measures. I was not then aware tha
considerable portion of the field is composed of horizon
or slightly inclined beds, although on Turkey creek I had
amined a single coal bed.

During a hasty exploration made last spring, I found t
the beds immediately north of the anticlinal line marked
the accompanying map, are either almost level, or sligh
inclined with a dip towards the north-east. A singular st
of things is found to exist in the northern portion of the fi
To understand this, it is only necessary to recur to the fa
that the Cahaba Coal Measures present in their structure
mense flexures, or folds, and that the level beds are found
the summit of these curvatures, whilst the inclined beds c
stitute their sides.

But I must refer to the reports on the geology of the St
for explanations of these phenomena. The lands of the co
pany examined by me are two tracts, a northern and south
one, the latter containing 3,360 acres, and the former 1,4
making in all 4,800 acres of productive coal measures. T
Alabama Coal Mining Company own other lands in the c
district which have not yet been worked, and the quality
coal on them is not known, though it is the opinion of th
who know most about them that they are rich in coal.

Watrous Bed.—To the south of the level tract on the m
will be seen the isolated quarter section, containing 160 ac
A seam of coal highly inclined, five (5) feet thick at the o
crop, is found here; it is known as the *Watrous Bed*, and
the most southerly coal exposed on the company's lands.

Pushmattahaw Beds.—The Little Mayberry creek flows over ne edges of the strata, and as it passes through a gorge in ne anticlinal ridge, it exposes the section Fig. A on the map, nown as the *Pushmattahaw Beds.* The strike of the beds is early east and west, and the dip 85 deg. towards the south. n the distance of 300 yards five or six seams of coal occur, which three at least are workable.

I propose at present to direct attention but to two of these, arked *a* and *b* on the map. As these seams are opened, a ir opportunity was presented for their examination. The ed *a* consists of two seams of 12 and 18 inches of coal, sep-rated by 8 inches fine clay, making 30 inches of coal. The ed *b* is 4 feet 6 inches thick, owing to the inversion of the rata here; the floor consists of sandstone marked with im-ressions of large coal plants, whilst the roof is composed of thick bed of indurated under clay, filled with *Stigmaria.*

The distance between these seams is 114 yards, so that by riving a cross-cut between them, the coal may be raised onomically from one shaft.

The Pushmattahaw Beds outcrop in the company's land for distance of one mile and a half, or 2,640 yards. Supposing e coal to be worked to the moderate depth of 150 yards, e thickness of clear coal in the two adjoining beds being 33 yards, and the specific gravity of the coal 1.304, from ese data we arrive at the fact that the Pushmattahaw beds ntain 904,924 tons of available coal.

Level Beds.—A little higher on the stream the strata lose eir great dip and become nearly horizontal. Indications of ore than a single bed occur here, but the sides of the ravine d the bed of the branch are covered with loose masses of ck that hide everything,—so that nothing absolutely certain as determined here. At the source of the stream the prin-pal outcrops of the level beds are found. The upper one of ese is known as *Woods' Pit.* The dip head level here is orth 47 deg, west, and the dip of the coal 1 in 9 towards the orth-east; portions of the seam are full three feet thick, but varies between this and two feet. Although the most ex-nsively worked of any of the Cahaba beds, it has not yet

been explored to a distance greater than 60 yards from t outcrop. About a quarter of a mile south of this, anoth exposure of the same seam is found, which is known as t *Fancher Pit.* Here the strike is found north 15 degrees wes and the dip 1 in 6. It is from these beds that the princip part of the coal hitherto carried to market from the Cahat coal fields, has been derived.

Still nearer the ridge, a drift has been commenced whic shows a course nearly east and west, with scarcely any di These are doubtless all outcrops of the same bed, changin in strike and dip as it approaches the anticlinal ridge. Fa ther west towards Murphy's creek, coal is exposed on the co ner of a quarter section of the company's lands.

This seam occurs within 60 yards of the vertical rocks, bu has itself a distinct dip in the opposite direction; and abou 50 yards north the whole series become horizontal. Abou one-half mile above the house of Mr. Davis, and very nea the creek, another seam is exposed under an enormous be of conglomerate. As the field has never been proved b boring, and the whole being one unbroken forest, it become very difficult, especially where the rocks are undulating o slightly inclined, to determine the number of beds superim posed upon each other, still I think it scarcely possible tha the bed exposed here can be identical with those laid bar farther west, and I am quite certain that the latter one is no

I have already mentioned that west of the outcrop of thes seams, there occur beds of shale, including coal plants an other pretty certain evidence of the vicinity of coal. But a I intend to base no calculations upon data not absolutely cer tain, I shall take into account only two seams positively know to occur; the one at *Woods' Pit,* and that at Murphy's creek which may be safely taken at an average of 30 inches each or an aggregate of five feet clear coal.

The dip decreases rapidly towards the north and east; a *Brown's Pit* it is 1 in 12, and if we take this as a average, the coal will be reached one mile from the outcrop at *Woods' Pit* at a depth of 150 yards. About two square miles of the trac occupied by the level beds are underlaid by coal, which give

ound numbers 10,071,694 tons of coal. Adding this to amount found for the Pushmattahaw Beds, and we will e—

	Tons.
hmattahaw Beds	904,924
el Beds	10,071,694
Total	10,976,618
luct one-fourth for all sorts of wastage	2,744,154
ount of available coal	8,232,464

he lower or southern tract, and within the short distance hree miles of the Ala. and Tenn. R. R. R.

'ustinuggee Beds.—The northern tract is at a distance of ut five miles from the nearest point of the Ala. and Tenn. R. R. Although this tract can scarcely be said to be ex- ed at all, it is known to contain some exceedingly inter- ng seams of coal.

n a small stream which, like the Little Mayberry, lays the upturned edge of the strata, the section represented he map at Fig. B. is found. In the short distance of 35 , more than three yards of coal may be seen at this fine lity. The first seam, at the northern end of the section, seven feet of coal, and is separated from the next, which 17 inches of coal, by a parting of shale eight inches thick. third seam is one foot thick, and the fourth has two feet lear coal.

esides these, there are some other beds towards the west t are also found outcropping on this tract; one of these I asured and found it to contain four feet six inches of coal. these beds are highly inclined, and dip towards the south. the following estimate I only take into account the first seams of the *Tustinuggee Beds*, making over eight feet of l, and four feet of the other bed, in all four yards.

hese beds occupy more than a mile in length at the out- p, as they extend across the tract. I suppose, also, that coal will ultimately be worked to the depth of 150 yards.

The amount of coal in this tract is equal to...	1,034,196 t
Deduct for waste one-fourth...............	258,549
Available coal........................	775,647

The total quantity of coal known to exist in both tract therefore, as follows:

Southern tract..............................	8,232,464 t
Northern tract..............................	775,647
Total on both tracts................	9,008,111

The cost of raising the coal at the pits, the cost of tr portation, and other incidental expenses, being known, Secretary can easily calculate the profits likely to accru your company from their investment.

The cost of transportation will be greatly reduced by construction of your proposed rail road to connect the with the Ala. and Tenn. R. R. R. The surface, at least the eastern side of the property, seems exceedingly favor judging from the profile constructed by the engineer who veyed the route—the grades being greatly in favor of the from the pits.

Quality of the Coal.—A sufficient quantity of coal ha ready been sent to the Mobile and Montgomery markets your pits, to have its quality, both as *fuel* and for the m facture of *gas*, fully tried. It may, however, be worth to compare it with other coals of a similar character which it may be likely to come into competition.

Dr. Mallet, who has charge of the chemical departme the survey, has analyzed two specimens, one from the *H mattahaw beds*, and the other from *Wood's pit*, with the lowing results:

Matter.	Wood's Pit.	Pushmattahaw Beds.
olatile Combustible.....	35.51	36.68
ixed Carbon...........	57.42	57.23
shes..................	6.31	5.30
oisture...............	.76	.79
	100.00	100.00
pecific gravity..........	1.294	1.304

It appears from these, that your coal belongs to the variety alled fat bituminous coal. Very few of the coals brought the Atlantic cities can compare with this for the manufacure of *gas*. Of thirty-four specimens analyzed, from the arious mines of Eastern Virginia, only three exceed, three re about equal, and the rest are much below it in the mount of volatile combustible matter.

Pre-eminent as are the Frostburg or Cumberland coals for he generation of *steam*, they stand far below the Cahaba oals for the production of *gas*. It is only in the western arts of Pennsylvania, Virginia, and Ohio, that beds of coal re found corresponding with them in bituminous matter.

With the arrangements already made for transportation by ail road to *Selma*, and thence to *Mobile* by the river, it will e easy to have a depot at the latter place, from which *New Orleans* and the Gulf may be supplied, and it would not be ery sanguine to hope, that a similar depot may be establshed at *Key West*, to supply steamers touching at that port. t is difficult to estimate the expansion of a trade like that in oal, where the certainty of the means of supply is once stablished.

The liberal policy of the Directors of the Alabama & Tenessee Rivers Rail Road will leave nothing to be desired the removal of every obstacle to transportation, and there nly remain the economical and active operations at the nines, that require most special attention.

Statistics of Coal.—I would very respectfully recommend

the opening of the Pushmattahaw Beds as near the term
of the proposed rail road and at as low a level as possibl
a large amount of your coal must be supplied from t
beds.

The shaft will, of course, be sunk on the plane of the
The common *whim* will be sufficient during the sinking o
shaft, but afterwards a *steam engine* will be required.

From the beginning everything should be done in the
manner, the track in the shaft should be laid permane
and the *trams* and other machinery of the best construc
The shaft should be divided by a brattice, one side bein
the raising of the coal, and the other for ventilation,
pump-tackle, and gangway for the miners. As to the
beds, all the coal won at the pits now open, will be taken
but no further expense incurred, working at the outcro
this way, apparently simple as it is, is the most trouble
and expensive of all methods, to say nothing of the
limited quantity of the coal that can be won, where the
crop is on the rise of the seam. The dip of the beds
indicate the proper position for the shaft from which the
seams should be worked. Between *Wood's Pit*, and the
vis bed, on the east, there is a difference of level of one h
red feet.

A miner of any experience would prove this part o
field by a few borings, that would not exceed in depth
yards each.

At all the pits arrangements should be made for drop
the coal from the trams, immediately on the screens; at
ent it is handled at least five times before it reaches *S*
each handling adding to the expense, and impairing the
of the coals.

I trust that the company will set the example, at the s
of discarding the absurd custom of disposing of coa
bulk, instead of *weight*. In closing this brief report, I ca
but express the pleasure I feel, in viewing this first, r
business like attempt, to open and unfold the riches of o
our great mineral deposits.

M. Tuom

APPENDIX B.

ALTITUDES FROM RAIL ROAD SURVEYS.

1. South & North Ala. R. R.

From F. L. Wadsworth, Engineer S. & N. Ala. R. R.

STATION.	ALTITUDE.
gomery	162 Feet.
ada	175 "
ore	199 "
sville	300 "
ntain Creek	542 "
ena	450 "
er's	458 "
ton	596 "
ax	625 "
son	706 "
Creek	540 "
a	502 "
ing	555 "
ia	464 "
am	427 "
na	400 "
ba Mines	400 "
k's	564 "
e's Creek	612 "
on	652 "
ingham	602 "
e	524 "
ingham	440 "
is'	408 "
rior	549 "
s	592 "
nt Springs	434 "
or	468 "
er	538 "
an	692 "
nan	802 "
er	840 "
ite	608 "
sville	603 "
selle	673 "
	569 "
tur	577 "
is	564 "
s	618 "
onald's	665 "
ns	709 "
s Mill	753 "
mont	798 "
essee Line	

2. Savannah & Memphis R. R.

From President Alexander.

STATIONS.	S.	T.	R. e.	ALTITU ABOV PENSACO
Opelika	7	19	27	819 F
Uchee Creek				774
Ridge				800
Loblocco				709
Gold Hill	13	20	25	770
Maddox				811
Big Sandy Creek				656
Ridge				736
Little Sandy Creek				660
Camp Hill	16	21	24	738
Creek				662
Dadeville	4	21	23	760
Buck Creek				670
Jackson's Gap				695
Manoy Creek				640
Ridge				683
Sturdevant	9	22	22	502
Tallapoosa Bridge	6	22	22	525
Ridge				760
Youngsville	27	23	21	747
Socopatoy Road	19	23	21	805
Kellyton	23	23	20	
Socopatoy Creek				748
Baker's Creek				810
Goodwater	15	24	20	872
Wildcat Creek				810
Ridge				845
Hatchet Creek	6	24	20	790
Pine Grove Church				889
Valley				820
Rayfield's Gap	18	22	5	896
Valley				842
Thomas' Gap	12	22	4	870
Syllacauga	29	21	4	590
Oden's Mill	18	21	4	508
Ridge				549
Childersburg	20	20	3	452

3. ELEVATIONS FROM SURVEYS MADE,

BY R. A. HARDAWAY, CIVIL ENGINEER, FROM 1850 TO 1870.

LOCALITY.	COUNTY.	S.	T.	R.	Valley or Ridge.	Elevation.	Base.
ville.	Butler	..	..	..	Ridge.	450 ft.	Gulf
Creek	"	18	10	16	Valley.	296	"
iga Creek	"	28	11	17	"	383	"
reek	"	16	11	18	"	375	"
Rocky Mount	Montgomery	12	11	18	Ridge.	598	"
Streak	Lowndes	1	10	16	"	513	"
enuggee	Bullock	33	14	24	"	625	Atlantic.
Hatchee.	"	23	14	24	Valley.	432	"
ee Creek.	"	5	14	26	"	342	"
"	"	..	..	..	"	310	"
bus, Ga		..	..	..	City.	265	"
"		..	..	..	River	200	"
Springs.	Bullock	..	..	..	Ridge.	516	"
Hatchee.	"	5	14	24	Valley.	400	"
e Creek.	"	21	15	24	"	390	"
age Road	Macon	10	16	25	Ridge.	455	"
e Creek.	"	3	16	25	Valley.	380	"
cla Creek.	Lee	9	18	26	"	475	"
a	"	18	19	27	Ridge.	8[illegible]0	"
Jefferson.	"	18	20	27	"	840	"
ppah Creek	Chambers	18	21	27	Valley.	665	"
ette	"	12	22	26	Ridge.	865	"
wn.	"	19	24	26	Valley.	642	"
Pine Creek.	"	3	24	25	"	625	"
a	Randolph.	12	22	10	"	620	"
Pine Mountains	"	5	21	13	Ridge.	1,320	"
vee	"	..	..	..	"	1,021	"
vee Creek.	"	33	19	11	Valley.	775	"
Tallapoosa	"	20	19	11	River.	757	"
ng Ridge	"	22	18	10	Ridge.	1,100	"
l'poosa, Nixon's F'd.	Cleburne	..	..	..	Valley.	780	"
's Bridge		29	17	10	River.	815	"
it Cahulgee Gap, viston	Cleburne	5	16	10	Ridge Coosa & Tal. waters	925 120 1,045	Selma. Savannah.
Coosa Water.							
Grove Creek.		..	..	..	Valley.	780	"
ng Ridge "Dug-n" Mountain		..	..	..	Ridge.	1,045	"
allapoosa Water.							
gee Creek		..	..	..	Valley.	890	"

Elelations of the different Stations on the Selma, Rome & D ton Rail Road above tide-water of the Alabama river.

STATIONS.	FEET.	M F SE
Selma	147	
Veto.	185	
Burnsville	207	
Clay's.	218	
Peeples'	238	
Plantersville	266	
Dixie	307	
Maplesville	381	
Coxe's	398	
Randolph	573	
Bibb Mills	471	
Ashby	481	
Brierfield	413	
Montevallo	494	
Calera	522	
Gardner's.	567	
Shelby Springs	554	
Columbiana	560	
Wilsonville	452	
Coosa River	445	
Coosa Station	472	
Childersburg	441	
Kymulga	451	
Alpine	495	
Barclay	534	1
Talladega	586	1
Curry's	565	1
Munford	646	1
Silver Run	655	1
Oxford	678	1
Blue Mountain	816	1
Jacksonville	653	1
Harris	709	1
Patona	714	1
Cross Plains	722	1
Ladiga	696	1
Amberson.	727	1
Griffith's Mills	716	1
Sword's Mills	766	1
State Line.	930	1
Prior's, Ga	844	1
Cave Springs	697	1
Six Mile	709	1
Rome	652	1
Rives'	658	..
Harbers	673	2
Dalton	782	2

APPENDIX C.

Statistics of the Iron Industry of Alabama.

1. *Alabama Iron Company.*

ost-Office, Alabama Furnace, Talladega county, Ala., on na, Rome & Dalton R. R. S. S. Glidden, President; Jas.)rr, Treasurer.

his Furnace was started October 1, 1873. Only one k 41 feet high; 8 feet 8 inches across the bosh; open top. nace yields from 20 to 22 tons of foundry iron per day. blast; 3 blowing cylinders, 40 inches in diameter, and 6 stroke; steam cylinder 21 inches in diameter and 6 feet ke; fuel, charcoal; ore, brown hematite; ore beds about a mile from furnace; limestone about the same distance.

2. *Tecumseh Iron Company.*

ost-Office, Tecumseh, Cherokee county, Ala., on Selma, ne & Dalton R. R. Willard Warner, President and Man-, Tecumseh, Ala.; W. F. Mason, Secretary and Treasu- Rome, Ga.

his Furnace was put in blast February 18, 1874. One k 12 by 60 feet, with top closed by bell and hopper; acity, 20 tons per day; present yield, 15 tons; product, blast charcoal pig iron; blowing cylinder 84 inches diam-, 48 inches stroke; steam cylinder, 36 inches diameter, nches stroke; engine run by 4 boilers in two batteries; ers 50 feet by 40 inches; engine upright, direct action, the works of Messrs. Ainstie, Cochran & Co., Louisville, Ore, brown hematite, from beds in the immediate ity of the furnace; limestone at two points within a quar- of a mile from the furnace; fuel, charcoal, made in bee-

hive ovens, in which the yield is 50 bushels of coal to t cord of wood.

3. Stonewall Iron Company.

Post-Office, Stonewall, Cherokee county, Ala., on Sel Rome & Dalton R. R., about three miles from the Geor line. J. M. Selkirk, President; J. W. Bones, Secretary a Treasurer; Wm. Wurts, Superintendent.

One stack 40 feet high, 11 feet across the bosh, open to yield per day, 18 tons; product, pig iron; hot blast; eng 100 horse power, horizontal; steam cylinder 22 inches in ameter, 6 feet stroke; blast cylinders, three in number, inches in diameter, 6 feet stroke; fuel, charcoal; ore, bro hematite; ore beds, near the furnace.

4. Shelby Iron Company.

Mr. Walter Crafts, Superintendent; Col. J. S. Black, Assi ant Superintendent. Mr. - - Witherby, Secretary. Ne Columbiana, Shelby county, Ala.

This company has been active for thirty years. There a two furnaces. No. 1, 12 by 56 feet; No. 2, 14 by 60 fe Average yield per day of No. 1 is first blast, 13 tons; seco blast, 18 tons; third blast, 14 tons—in tons of 2,268 lbs. T first-two blasts were on hot blast pig iron, and the last on c wheel pig iron. Furnace No. 1 blew out, December 15, 187 having made a run of three years, nine months and fifte days.

Furnace No. 2, went in blast January 6, 1875, and h made an average thus far (February 2, 1875,) of thirteen to per day.

Size of Engine No. 1.—Blowing cylinder 66 inches, and feet stroke.

Engine No. 2.—Blowing cylinder 84 inches, and 4 fe stroke. Waste gases are taken from the tunnel head a used for heating the boilers.

Ore, brown hematite, and ore banks near the furnac Limestone opening three miles from the furnace, at the te minus of a narrow gauge rail road. Fuel used, charcoal.

5. Brierfield Iron Works.

ost-Office, Brierfield, Bibb county, Ala., on Selma, Rome
alton R. R. T. S. Alviss, Superintendent. Now idle.

6. Woodstock Iron Works.

ost-Office, Anniston, Calhoun county, Ala., on Selma,
ne & Dalton Rail Road. A. L. Tyler, President; Samuel
le, Secretary and Treasurer.

he furnace went in blast April 13, 1873. One stack
feet high, 12 feet bosh; closed top. Capacity, 500 tons
month; all pig metal for car wheel and foundry purposes.
st, hot and cold; can change on cold blast in a few min-
. Blowing cylinder 72 inches in diameter, 4 feet stroke.
ine cylinder, 30 inches, and 4 feet stroke. Gas is used
heating the boilers.

re, brown hematite; ore within $\frac{1}{4}$ mile of the furnace,
mited in extent; limestone, 4 miles distant; contains
4 Carbonate of lime.

7. Cornwall Iron Works.

ost-Office, Cornwall, Cherokee county, Ala.
have been able to get no information concerning this
ace.

8. Rock Run Furnace.

ost-Office, Pleasant Gap, Cherokee county, Ala.; Selma,
ne & Dalton R. R.

9. Eureka Iron Company.

ost-Office, Oxmoor, Jefferson county, Ala., on S. & N. Ala.
. James Thomas, Superintendent.

he works here consist of two furnaces formerly used for
ing charcoal iron; they are now being remodeled for
. The size of the furnaces, 14 feet bosh, 59 feet high;
th 6 feet; tunnel head 14 feet.

he blowing engine, steam cylinder 36 inches and 4 feet
ke. Blast cylinder, 7 feet diameter and 4 feet stroke.

There are 6 boilers, 50 feet long; four are 42 inches in ameter, the other two 28 inches.

Coke ovens at the furnace, 28 in number; built upon horizontal or Belgian system, 24 feet long. Height of c in oven 4½ feet. To spring of the arch from the bott 5 feet. Ore, Red mountain fossiliferous ore, mixed with o fourth limonite. Limestone comes from Red Mountain, low the ore.

10. Cahaba Iron Works.

Post-Office, Irondale, Jefferson county, Ala.; Alabam Chattanooga R. R. Thomas & McKee, Lessees. Now i

11. Iron Works.

Post-Office, Woodstock, Bibb county, Ala.; Alabama Chattanooga R. R. Mr. Giles Edwards, Superintend Has not yet been put in blast.

12. Central Iron Works.—Rolling-Mill.

Post-Office, Helena, Shelby county, Ala., on South & No Ala. R. R. R. W. Cobb, President; R. Fell, Jr., Secreta R. Fell, Superintendent.

This establishment has 4 puddling furnaces, and one he ing furnace; 3 engines, of which one of 120 horse po drives the mill; 1 muck mill; 1 guide and hook mill co plete; shears, squeezer, and punches necessary for the ope tion of the mill.

The manufacture of the Alabama Loop Cotton Tie is ma a specialty. Capacity about 1,000 tons per year.

July 3, 1903.
21,503.

GEOLOGICAL SURVEY

OF

ALABAMA.

REPORT OF PROGRESS FOR 1876.

BY
EUGENE A. SMITH, PH. D.,
STATE GEOLOGIST.

MONTGOMERY, ALA.:
W. W. SCREWS, STATE PRINTER.
1876.

Geological Survey

OF

ALABAMA.

With the compliments of
Eugene A Smith,
State Geologist,
University of Alabama.
Tuscaloosa County, Ala.
Please acknowledge receipt.

EUGENE A. SMITH, ...,
STATE GEOLOGIST.

MONTGOMERY, ALA.:
W. W. SCREWS, STATE PRINTER.
1876.

'o *His Excellency*,

GEORGE S. HOUSTON,

Governor of Alabama:

SIR—The Report of Progress of the Geological Survey, r the year 1876, is herewith respectfully submitted.

I have the honor to be, sir,

Your obedient servant,

EUGENE A. SMITH,

State Geologist.

UNIVERSITY OF ALABAMA,

November 30, 1876.

TABLE OF CONTENTS.

PREFACE.

rsuance of the plan followed in previous years, the rk of the Survey during the past season, has been chiefly to the Silurian formations exposed in the al valley, known as Roup's Valley and Jones' Val- cidentally, the geological formations, more recent e Silurian, exhibited in this valley, have received n. It has been seen in previous reports, that the formation in Alabama is the great repository of s. In the valley, in part described in this Report, e red and the brown ores occur in great abundance superior quality. The banks of brown ore are in arts of the valley, of extraordinary extent. The roximity of the ores, both red and brown, to the lds of the Warrior and Cahaba, will, some day, is one of the chief centers of the iron industry in a.

e knowledge of the Coosa coal fields, we are en- make in this Report a small contribution, in the nation of the limit towards the south and south- this field. The capabilities of this portion of the , as yet, almost unknown.

bjects of the Survey include, amongst other things, ly and description of the fauna and flora of the nd as the first contribution in this direction, we with this Report a list of the Fresh Water and Land

Shells of Alabama, with remarks upon their Geographical Distribution, from the pen of Dr. James Lewis, of Mohawk, N. Y., one of the first authorities on this subject.

The labors of Dr. Lewis, in the conchological department of the National Museum of the Smithsonian Institution, are well known to Naturalists. To the working student of Natural History, this paper will be heartily welcomed.

It is due to Mr. Truman H. Aldrich, of Montevallo, to state that it is owing to his liberality that we are enabled to publish this list, as he has defrayed the entire expense incurred in its preparation.

To the authorities of the Alabama and Chattanooga, and the South and North Alabama Rail Roads, acknowledgments are herewith made for the continuation of courtesies extended to the Survey in previous years.

Prof. Wm. C. Stubbs, of the Agricultural and Mechanical College, and Prof. R. B. Fulton, of the University of Mississippi, have taken an active part in the field work during the past summer, and it is my pleasant duty to recognize here obligations to them for the assistance they have rendered.

A general acknowledgment of the indebtedness of the Survey to individuals, at whose hands many favors have been received, is hereby made.

EUGENE A. SMITH.

University of Alabama, November 30, 1876.

ROUP'S AND JONES' VALLEYS.

INTRODUCTORY.

his first Report on the Geology of Alabama, Prof.
ney, in speaking of the Silurian rocks of this part of
State, says: "They (the Silurian rocks) are visible
t sixteen miles in a straight line south-east of Tuska-
, where the waters of the Big Sandy Creek have re-
ed the overlying loose materials that cover the surface
is part of the State. From this they extend north al-
without interruption, to the head of Murphree's Val-
separating the Warrior coal field on the west from that
e Cahaba on the east. In this direction they are con-
to a series of continuous valleys, that rarely exceed
n or eight miles in breadth; they are, in truth, but one
y, although designated by different names. The
hern extremity has received the name of Roup's Val-
the middle portion, which includes the towns of Jones-
ugh and Elyton, and extends to Village Springs, is
d Jones' Valley; whilst the part between the Village
ngs and the upper extremity, where it is lost in the
on Mountain, has the appellation of Murphree's Val-

e fact that this valley occupies the summit of an an-
al fold was also noticed by Tuomey.

uring the past season, the field work of the Survey has
devoted chiefly to the examination of the southwest
on of the valley known as Roup's and Jones' Valleys.
fore proceeding to the description of the geological

structure of the valley, it may be well, for the convenience of the reader, to give a short table of the sub-divisions of the Silurian, Devonian and Carboniferous formations.

A more extended description of these formations, as exhibited in some parts of Alabama, will be found in my Report for 1875.

Beginning with the lowest, these sub-divisions are:

A.[1] LOWER SILURIAN.

1. Acadian.
2. Potsdam.
3. Calciferous—Knox Sandstone.
4. Quebec— { Knox Shale. Knox Dolomite.
5. Chazy.
6. Trenton.
7. Utica.
8. Cincinnati.

A.[2] UPPER SILURIAN.

1. Niagara.

The remaining sub-divisions of the Upper Silurian have not yet been observed in Alabama.

B. DEVONIAN.

1. Hamilton (?) Black Shale.

C. CARBONIFEROUS.

1. Siliceous Group. } Sub-Carboniferous.
2. Mountain Limestone. } Sub-Carboniferous.
3. Coal Measures—Carboniferous.

As we meet in this valley for the first time, with considerable exposures of the rocks of the Niagara period, which were only casually mentioned in my Report for 1875, a more detailed description will not be out of place here.

The New York geologists, to whom we owe the classifi-

ınd description of the Silurian beds, have divided
gara into three groups, as follows, beginning with
est:

Medina—Including the Oneida Conglomerate, and
dina Sandstone.

Clinton.—Sandstones and Shales, with beds of len-
and fossiliferous red iron ore.

Viagara.—Shales and limestones.

ıese three groups of the Niagara period, so far as is
only the second, *the Clinton*, has been certainly
ed in Alabama. In Tennessee, the group has re-
he name of the *Dyestone Group* from Prof. Safford,
unt of the occurrence in it of the red ore, or dye-
In Alabama, no more fitting name could be given
an the *Red Mountain* group, for outcrops of the
f this group are found in ridges, or mountains, as
e called, extending almost without interruption from
unty to Georgia, and beyond. From the red ore,
eems always to be present in them, in greater or
ckness, these ridges have the local name of the Red
in.

ıame Clinton, however, has already been applied to
up of rocks, and a multiplication of names for the
ing is to be avoided if possible.

rocks of the Clinton group in Alabama, are chiefly
dstones and shales, which are variously colored—
yellowish, brown and red colors being predominant.
up contains also several beds of lenticular or fos-
s red iron ore. For characteristic sections of the
f the Clinton group, the reader may be referred to
ion near Tannehill, and that at the mines of the
Company.

sandstones and ore beds of this formation, hold, lo-
great numbers of characteristic fossils, amongst
Pentamerus oblongus, usually represented by the casts
interior of the shell, and varieties of corals and

bryozoans, are nearly always found. So far as the fossils go, there is no reason for thinking that any of the Oneida and Medina rocks are represented in the Red Mountain ridges of Roup's and Jones' Valley.

GENERAL ACCOUNT OF THE GEOLOGICAL HISTORY AND STRUCTURE OF THE VALLEY.

During the period of disturbance, which, according to the geological authorities, followed the deposition of the Coal Measures, a comparatively narrow belt of land, running approximately parallel to the outline of the Atlantic coast, from the Green Mountains and beyond, down to Alabama, was pressed up into numerous wrinkles or folds. This belt has received the name of the Appalachian region, and includes the Blue Ridge and the Alleghany Mountains. Going across this region from the Atlantic, northwestward, we should accordingly expect to find a series of ridges with trough-like depressions between; we should expect to find the strata of the ridges sloping away southeast and northwest from the axis of the ridges, and the strata of the depressions sloping both ways towards the central line or axis of the depressions; in other words, we should expect to find a series of *anticlinal* ridges and *synclinal* troughs. The atmospheric agencies, during the long period which has elapsed since the disturbances alluded to, have, however, tended to obliterate the features thus impressed upon the land, by wearing down the crests of the ridges, and in some cases filling up the depressions between them, so that almost the whole of what now constitutes the scenery of this region—its mountains and valleys—is the result of denudation. The strata are still found lying at various inclinations to the horizon, sloping sometimes on both sides away from a central line, and sometimes on both sides towards a central line; but the anticlinals do not now mark the ridges, nor the synclinals the valleys, but the ridges or mountains, as we now find them, owe their prominence,

rally, to a capping of harder strata, such as sand-
es, &c., which has resisted denudation, whilst the val-
have been excavated out of the softer materials, such
mestones, and the like.

it there are other sources of complication in the geo-
al structure of this area. The strata have sometimes
too stiff and unyielding to *bend* into the sharp folds
which they have been pressed, and the result has been
eak or crack along the line of greatest strain, *i. e.*, the
of the fold, just as we can break a sheet of stiff card
d by bending it up into a close fold. The fissure thus
luced has furnished a channel for the denuding streams
h have excavated valleys along the crests of anticlinal
es. In this way, the anticlinal valleys have been
ed. And then, in many instances, the strata have
led still less to the folding, the fracturing has been
more profound, and the strata on one side of the frac-
have been pushed up over the corresponding strata on
other side, producing dislocations, or *faults*, as they
been termed. These faults are often miles in length,
the vertical displacement varies from a few feet up to
sands.

exures and faults are common throughout the whole
e Appalachian region, which has its southwestern ter-
ation in Alabama.

e valley which we are describing lies at the south-
ern end of this region, and an account of its geologi-
tructure will, it is hoped, be more easily understood
the foregoing remarks.

s already noticed by Prof. Tuomey, this valley occupies
summit of an anticlinal fold, having the coal basin of
Warrior on the west, and that of the Cahaba on the
. A simple reference to the map will show that it is
water shed between these two coal basins, for all the
ks having their sources in the valley, soon break
ugh the ridges of Millstone Grit at the base of the Coal
sures, and make their way into the Warrior and Caha-
The rugged, barren hills of the coal fields contrast

strikingly with the rolling, fertile lands of the valley, and we have presented here, as has been remarked by Prof. Safford, the curious case of a valley which is higher than the mountains. The geological structure of the region is, in general, as follows: In the middle of the valley, the strata belong to that sub-division of the Lower Silurian which I have called Quebec or Knox Dolomite; these rocks are found dipping generally towards the southeast, though in many places they dip both northwest and southeast. Crossing from the center of the valley southeast, towards the Cahaba coal fields, we go over the rocks of the Chazy and Trenton, the Niagara, the Black Shale, the Sub-Carboniferous, the Millstone Grit, and the Shales and Sandstones of the Coal Measures, all lying conformably and dipping southeast. Going northwestward, we find the same succession of strata up to the Coal Measures of the Warrior fields, the dip being sometimes northwest, though often southeast, a fact to be explained further on. Such, in the simplest terms, is the geological structure, and there is no doubt but that the coal basins of the Warrior and the Cahaba were once continuous; that at the time of the disturbances along the Appalachians, alluded to above, they, together with the underlying formations, down at least to the Quebec or Knox Dolomite, were uplifted into a long anticlinal fold; that this fold was fractured along its axis or summit, thus affording a channel for denuding waters; and finally, that the great mass of sandstones, coal beds, shales and limestones, which constituted the fold, has been broken down and removed by the action of running waters, till nothing is left of it now except a low rim on each side, adjacent to the Coal Measures.

The structure of the entire valley, however, is not always that of a simple regular anticlinal, with its beds sloping away on both sides from the center. In the southwestern extremity, the fold has been lapped together and pushed over towards the northwest, reversing the dip, so that all the strata dip southeast, and the newer rocks on the northwestern side are found *under* the older ones. As

rther complication of the structure, it may be added
; in many places there are faults or dislocations, by
ch, on the one hand, some of the beds have been con-
ed, and, on the other hand, some have been duplicated.
tances of both kinds of faults will be noticed in the de-
s below.

'he narrowness of the valley, six to eight miles, from
l field to coal field, and its abundance of iron ores, con-
ing of limonites, and of the fossiliferous red ores, the
er forming part of a ridge on each side of the valley,
practically inexhaustible quantity of good limestones,
nbine to render this portion of the State peculiarly
pted to the production of iron.

GEOLOGICAL DETAILS.

toing southeast from Tuskaloosa, towards Scottsville,
ks of the Coal Measures form the country as far as the
rdy Clements old place, in S. 25, T. 22, R. 8, W. Along
; road, coal has been dug at times at Kennedale, at Mrs.
nistead's, S. 30, T. 21, R. 8, W., at Mr. Bowen's, S. 22,
22, R. 8, W., and at many other places. At Mr. Bow-
, on Lie Branch, is the last exposure of coal, so far as
et known, towards the south, and a short distance be-
his place the deposits of the drift cover everything.

t Mr. Ben. Clements', on the old Hargrove road, about
3, T. 24, R. 7, W., the waters of Big Sandy have cut
ough the Millstone Grit, here exposed in two heavy
ges standing nearly vertical and striking almost north
l south. This is the lowest exposure of this rock yet
erved, and here the distinctive features of the anticli-
valley seem to be lost under overlying drift. The lith-
gical characters of the Millstone Grit here, as at all
er places where it has been observed in this valley, are
se of a quartzose sandstone, or sometimes a conglom-
te. Under the lens, it is seen to be composed almost

exclusively of quartz grains, and is very unlike, in appearance, the ordinary sandstones of the Coal Measures.

The ledges of this rock are exposed on both sides of the creek; on the south side they can be traced only a short distance, but northward and northeastward, as far as Birmingham, and, indeed, probably to the head of Murphree's Valley, the same rock is found in nearly vertical ledges, marking the western limit of the valley.

Going from this lowest outcrop of the Millstone Grit, northeastward, no well-defined exposure of the red ore of the Clinton group was observed, though a sandstone, having many of the characteristics of the Clinton sandstone is seen on the old Hargrove road, a mile or two southwest of the Hardy Clements old place, and at the last named locality, the strata of Knox Dolomite are seen in great force. It seems probable that the Knox Dolomite outcropping here, belongs to the lower beds of the group, for there are many strata of a blue banded argillaceous limestone, such as characterize the lower part of the Dolomite elsewhere, at Montevallo for instance.

At the ford, a thin bedded limestone strikes nearly north and south, dipping east, but a short distance higher up the creek, the characteristic sandy dolomite, with rough, hacked surfaces, lies in thick beds, striking north 15° east, and dipping southeast 35°–40°. Several beautiful and bold springs burst up from beneath the dolomite. One of these, the Blue Spring, so called from the color of the water, has a basin about ten feet square. The water boils up in considerable volume, and this spring, which is about half a mile above the ford, is a fair type of the numerous limestone springs which characterize this formation.

Strata of the Knox Dolomite are exposed along the course of Big Sandy, below Clements', at least as far south as S. 2, T. 24, R. 7, E., of the lower survey. Northward from Clements' they are seen along a little branch, tributary to Big Sandy, in sections 24 and 18, T. 22, R. 8, W., upper survey, and northeastward are outcrops at intervals

; Big Sandy, in sections 24, 25, 17 and 16, of T. 22, W. At the latter place are the lime kilns.

Mr. Frank Goodson's place, S. 2, same township and e, these rocks are observed again, continuing thence ably without material interruption northeastward to e's, and up the valley. From Goodson's south, or a southeast, to Mars P. O., and on to the Hill place, make the country. Beyond Hill's, in this direction, oon come upon the rocks of the Cahaba coal fields. intervening rocks, viz: Chazy and Trenton, Clinton, x Shale, and Sub-Carboniferous, I have not noticed in mmediate vicinity, though they are seen fully devel- a few miles further northeast.

going northward from the Hardy Clements place to ents' Station, on the A. & C. R. R., in S. 1, T. 22, R. ., the way lies through the pine woods of the Coal sures, (Warrior,) after passing the outcrop of Knox mite, already mentioned. The Millstone Grit and intervening strata between the Knox and the Coal sures, were not exposed along the route traveled.

the vicinity of Clements' Station, numerous openings been made for coal, some of which were visited.

Johnson's mine, in S. 2, the seam of coal is 18 to 24 es in thickness, in two benches separated by a few es of shale. These numbers apply to the exposed bed e mouth of the mine. The roof is a hard sandstone, 10 feet thick, and the floor fire clay. Above the sand- e is a thick bed of conglomerate, with pebbles some- s as large as the end of the thumb. This rock, which xposed in this vicinity, in all the little depressions ed by denudation by the tributaries of Lie Branch, re- bles very much a conglomerate overlying some of the beds at Tuskaloosa.

her openings, said to be upon the same bed as John- , are those of Devereux Brown, Hardy Clements and itt. About one mile further southwest is the Jones and two miles beyond, the Bowen bed mentioned e. All these are on Lie Branch. Further up the

creek is the Woodel bed, and in S. 1, T. 22, R. 8, W., the R. H. Clements bed, from which place outcroppings of coal may be seen at intervals to the station.

At the present time, no work is going on at this Clements mine, though a large amount of coal has been raised here. The thickness of the seam is 39 inches, and the quality of the coal said to be very good. I believe that preparations for renewing the work are now in progress.

Across the railroad, north of the station, and within the distance of two or three miles, are likewise several coal openings, which, however, are now lying idle. On account of the caving in of the ground over the openings and the water in the pits, there was no chance to see any of the coal seams.

The beds where examined, have a very slight dip, and there seems to be no very good reason why they might not be reached by a shaft at the station, by which the expense of hauling in wagons, over rough roads, and from distances of half a mile to three or four miles, might be avoided.

At the old stage stand, about one mile from Clements' Station, are some fine springs of freestone water, known as Wheelock's Springs.

East of Clements' Station, at the intersection of the Huntsville with the Scottsville road, the chert of the Knox Dolomite is observed, but from that point to Smallwood's Station, it is generally covered by the drift. At Smallwood's, the Dolomite is the surface rock again. At Vance's Station, strata of a flaggy limestone, nearly vertical, and full of fossils, are shown in a railroad cut. East of this station, the pine woods hills are covered with a ferruginous sandstone, similar to that so common in the drift. This sandstone, in places, is rich in iron, and pieces which might be very fair samples of limonite, are not uncommon. This passage of ferruginous sandstone into limonite has already been noticed in Bibb county, near Pratt's Ferry, near Ashby Junction, &c., and other occurrences of it will be described beyond.

Northwest of the railroad, at Vance's, and within the

nce of two miles, we find the Millstone Grit well ex-
d. This rock is seen in two or three ledges. The first
ese, nearest the railroad, stands nearly vertical, with
ght slope, however, to the southeast. Where a branch
cut through this rock, I observed, in several places,
a of yellowish shales, with surfaces coated with a thin
film. These shales, like the Millstone Grit, are al-
vertical, and distant only 50 to 60 feet from it, south-
They are probably shales of the Sub-Carboniferous
ation, since similar shales have frequently been noticed
pying a similar position with reference to the Millstone
on both sides of the valley above this point.

me two hundred yards northwest of the first bed of
stone Grit is another bed of quartzose sandstone, pre-
y similar, and, like the first, nearly vertical, though a
t inclination was noticed towards the northwest.

a short distance still further northwest, nearly hori-
al, beds of a coarse grained quartzose sandstone are
untered, and beyond these the sandstones and shales
e Warrior field.

few miles northeast of Vance's, very much the same
sures of rocks may be seen. The first beds of Mill-
e Grit, making high and precipitous cliffs, mark the
of the valley towards the west. Below these, at the
foot of the cliffs in fact, the black and yellowish Sub-
oniferous shales are exposed wherever a little branch
cut through the hard rim of sandstone, the shales hav-
bout the same dip as the sandstone, nearly vertical.
ne point, the Knox Dolomite and the sandstone were
in clear exposures, separated by a ravine not more
100 yards across; the strata of the Dolomite dipping
heast, at an angle of 45° or less, the sandstone nearly
cal, say dipping 85° southeast.

offering an explanation of these facts, we have to bear
ind that crossing from the Knox Dolomite of the val-
t this point westward, instead of encountering in suc-
ion the strata of the Chazy and Trenton, Clinton, Black
le, &c., we come from the Dolomite, in less than one

hundred yards distance, directly upon the Millstone Grit, with a few feet of Sub-Carboniferous shales exposed below it. All the strata between the Knox Dolomite and the Coal Measures, except the few feet of Sub-Carboniferous, have disappeared.

We have here a fault by which the Dolomite of the Lower Silurian has been pushed up against the rocks of the Coal Measures, thus covering the strata between. That besides the vertical displacement, there has been also a sliding of the lower Silurian rocks upon the upturned and folded back or reflexed edges of the Carboniferous strata, seems probable when we consider the difference in dip of the two sets of rocks.

This fault does not extend, however, very far towards the northeast, or at least the vertical displacement seems not to be so great, since west of Woodstock there is a well defined ridge of Clinton rocks, with accompanying red ore, between the Dolomite and the edge of the Coal Measures.

The presence of almost *horizontal* beds of hard quartzose sandstone, apparently identical with the Millstone Grit, and not more than five hundred yards west of the *vertical* beds of the latter rock, is a noteworthy fact.

These horizontal beds of sandstone are sometimes found lying bare over considerable areas. One of these, the "Eight Acre Rock," as it is called, is a bare rock, (thirty or forty acres in extent,) composed chiefly of quartz grains, with some strata of a conglomerate, with pebbles as large as peas.

Lithologically, this differs very much from the ordinary sandstones of the Coal Measures, and resembles nothing so much as the Millstone Grit near it, and with which it is no doubt identical.

This would give, at a rough estimate, over eight hundred feet in thickness to this bed.

On the "Eight Acre Rock," the beds are intersected by two sets of joints, running northeast and northwest respectively. Some of these joints have widened out into fissures of several feet, and twenty to thirty feet deep. The sur-

of the rock has been weathered into numerous little
tions and depressions, the latter filled with white sand,
ort a scanty growth of a Hypericum, and one or two
hardy herbs. Besides these, only the prickly pear
us) and patches of yellow lichens obtain a hold upon
are rock. At the western edge is a large cave, formed
projecting ledge.

some respects, this reminds one of the "flat rocks"
anite in the Metamorphic regions of the State.

ove Vance's, and near Mrs. Dowdell's, the Cherty
mite forms several rocky knobs, and in one of these is
e with fine stalactites. The smoke of torches has
ened the surface of these, but when broken off they
handsome crystalline structure.

ove Vance's Station begin the beds of limonite, which
directed so much attention to Roup's Valley. At the
section of the Huntsville and Columbiana roads, is
f these ore banks, of considerable extent. Between
nd Bibbville, the hills are usually covered with drift,
the concretionary ferruginous conglomerate, before
ioned, is of universal occurrence.

Bibbville, a manufactory of fire brick was an object
terest. The material for the brick is obtained from
pits close to the station. It consists—1, of a toler-
white and plastic clay; and 2, of a moderately coarse
ed arenaceous deposit, made up of grains of quartz
held together by a clayey cement. The baked brick,
examined with the lens, resemble, to some extent,
mens of Millstone Grit, the quartz grains being a
inent ingredient.

ese bricks are much used in the construction of the
ces and rolling mills, and are highly recommended by
using them.

ar Esquire Green's, a few miles southeast of Wood-
, is a fine exposure of the Chazy limestone, in the
characteristic ledges along a hillside. A rough
urement gave some four hundred feet thickness of the
.

The lower beds held numerous shells of *Maclurea magna*, which seemed to be absent from the uppermost beds.

The fossils of these upper beds have more resemblance to Trenton fossils. At this outcrop, the strike is N. 26° E. and the dip S. E. 30°. Further towards the southeast come, in regular succession, the yellowish fossiliferous sandstone of the Clinton age, with its red ore; chert, with fragments of crinoidal stems, of Sub-Carboniferous age; (the Black Shale between these two formations was not noticed at this point;) Millstone Grit, and the beds of the Cahaba coal field. The Clinton and Sub-Carboniferous, with Black Shale included, are usually associated together on each side of the valley in a tolerably well defined ridge, generally lower than the ridge of Millstone Grit, though sometimes, as near Jonesborough and Birmingham, it is higher. At this point, however, neither of the formations mentioned forms a prominent ridge.

The dip at all the outcrops noticed was southeast.

Woodstock, in S. 15, T. 21, R. 6, W., is upon the central Knox Dolomite of the valley. At this place a furnace has been erected by Mr. Giles Edwards, which has not yet gone into blast. Near the furnace is an ore bank near outcrops of cherty Dolomite, showing a moderate dip 10°—15° southeast.

Caffee's Branch, which has its source not far from Woodstock, runs, for the first two miles of its course, through beds of limonite. At the head of the branch is one of the most extensive of these deposits.

Through the courtesy of Mr. Edwards, I am enabled to give an analysis of this ore, made by Dr. T. M. Drown, of Lafayette College, Easton, Pa.

Analysis of Limonite from head of Caffee's Branch.

Iron (metallic)...........	50.68	
Insoluble (silica, &c.,)....	9.80	
Sulphur................	none	
Phosphoric Acid.........	0.31	—0.12 Phosphorus.
Alumina................	3.75	
Manganese	none	

The following analyses of limonite, from near Woodstock, will fairly represent the quality of the ore at this point:

	No. 1.	No. 2.	No. 3.
Combined water	11.35	12.14	11.55
Siliceous matter	2.46	12.16	2.98
Sesquioxide of iron	84.46	75.04	82.83
Alumina	0.91	0.30	1.39
Oxide of manganese	0.33	0.00	1.02
Lime	0.26	0.41	trace.
Magnesia	0.04	0.06	0.12
Phosphoric acid	0.58	0.00	trace.
Sulphur	0.14	0.14	0.14
Metallic iron	59.15	52.55	58.01
Phosphorus	0.25	none.	trace.

No. 1. From Tuscaloosa county, Section 9, Township 21, Range 6, west, near Woodstock Station. Analyzed by Prof. N. T. Lupton.

No. 2. Same locality, and analyst.

No. 3. " " " "

Greenpond Station, in S. 11, T. 21, R. 6, W., is near the southeastern edge of some very large limonite banks; the excellent quality of the ore will be seen by reference to the analyses below. A few hundred yards below the station a railroad cut has passed through an ore bed of considerable extent; southeast of the cut, the ore may be seen on the surface over several acres. This, I believe, is the property of Dr. Ragsdale of Greenpond, and to the same gentleman belongs another large deposit of ore, just east of Thomas' switch.

On the west side of the rail road at this place, Mr. Giles Edwards is engaged in raising ore for the Oxmoor Furnace, where it is used mixed with the red ore from the Clinton or Red Mountain strata. Mr. Edwards has erected here machinery for washing the ore, and a tram-way of one-fourth of a mile, connects his ore bank with the rail road.

Mr. Edwards has furnished me with these analyses of the ore taken from different localities on this bed, which has several acres superficial extent.

The analyses were made by Prof. Rœpper, of Lehigh University.

Analyses of Limonite from Edwards' Bank, near Greenpond.

	No. 1.	No. 2.	No. 3.
Sesquioxide of Iron	83.89	84.25	57.46
Insoluble, (Silica, &c.)	3.28	3.10	34.03
Water	12.51	13.09	8.55
Phosphoric Acid	trace.	trace.	trace.
Metallic Iron	58.75	59.00	40.24

It will be seen that No. 3 was a clayey specimen. The excessively small quantity of phosphoric acid found in all three specimens, is rather remarkable for limonites.

About one-fourth of a mile north of the station, in S. 11, at various localities in S. 2, T. 21, R. 6, west, and also in S. 35, T. 20, R. 6, west, banks of limonite, remarkable at least for their vast extent, were visited. I have, as yet, no analyses made of the ores from these localities, and, of course, can say nothing of the proportion of phosphorus contained in them, but the per centage of metallic iron would probably average 55 per cent. Hills, one hundred feet and more in height, and several acres in area, composed, to all appearance, of almost solid limonite, are not rare in this vicinity; indeed, the limonite being more resistant to denudation than the calcareous rocks with which it is associated, forms a large per centage of the hills and smaller elevations for a distance of five or six miles northeastward. The soil upon these ore hills seems to be quite productive, and the hills desirable farming lands, if one may judge by the crops growing upon them, and especially by the tons of ore, which have been heaped up in piles, and walls, in order to prepare for the plough, small patches of ground.

verage samples of the ore from several typical locali- in the vicinity of Greenpond have been collected, and analyses of them will be presented at some future .

S. 15, T. 20, R. 6, west, the sandstones, &c., of the ton group, are found dipping southeast; these rocks three beds of the red ore, 7 feet, 4 feet, and 3 feet thick, ectively, and occupying about 40 feet of strata. These surements were made by Mr. Edwards, and are given n his authority.

oing northwest from this outcrop of Red Mountain s, we come within one-fourth of a mile, upon a stratum Black Shale, followed by a ridge of bedded chert, and ne hundred and fifty to two hundred yards of dark calcareous shales, alternating with sandy calcareous s. These beds of chert and shales are Sub-Carbonifer- and dip at a high angle, 80° or more, towards the heast. By the section above given it will be seen that have been pushed over so that the newer beds are d *underneath* the older.

he Millstone Grit, which follows close upon the calca- s shales just mentioned, is exposed in a fine, charac- tic section, where a branch of Davis' creek has cut its through from the *Valley* into the *Mountains* of the measures. In this cut the rock stands nearly vertical, as the case near Vance's, below, but passing through the Warrior coal measures, the sandstones and shales rapidly into a more horizontal position, and within a of the vertical ledges of the Millstone grit, the rocks he coal measures have very little dip. Near the center . 26, T. 20, R. 6, west, an opening has been made upon of the lowest of the Warrior coal beds. The coal is in e benches, of about eighteen inches each, separated by clay partings, the upper three inches, and the lower ve inches thick.

we compare the section across the valley here, with at Vance's, described above, we find this difference: the Knox Dolomite, instead of being almost in con-

tact with the Millstone Grit, or at most, with a few hundred feet only of Sub-Carboniferous shales between, as was the case below, is succeeded by the Clinton, Black Shale, and Sub-Carboniferous beds, (the Chazy and Trenton were not noticed here, but they occur a few miles northeast.) The faulting here has therefore not been so great, or in other words the Knox Dolomite has not slided over and concealed the newer beds to the extent noticed below. If there is any displacement here, it is comparatively slight, for, though no Chazy beds were observed, they would probably be found by a closer search. The two sections have, in common, the vertical (or nearly vertical,) beds of Millstone Grit, and Sub-Carboniferous, dipping as much as 85° S. E., thus bringing the newer *under* the older rocks.

There could hardly be a clearer instance of the inversion of strata than that shown here.

Near Tannehill station we have one of the best sections across the valley. The eastern side of the anticlinal being the simpler, its geological structure will be given first, and from this the more complicated relations of the rocks on the western side may be somewhat clearer.

Tannehill station is upon the central Knox Dolomite, near its upper beds, for within one-fourth of a mile from the station going eastward we find some 350 feet in thickness of beds of the purer limestones and dolomites of the formation exposed near the bank of the creek. Some of these beds weather very smoothly, showing tolerably uniform composition—some have been quarried for lime; others are light gray dolomite, breaking with smooth conchoidal fracture. A few layers of tolerably pure blue limestone are here intercalated.

Succeeding these are beds of rough sandy dolomite with much chert, making a cherty ridge which may be seen at the upper mill; characteristic exposures of this rough cherty dolomite are found at the mill and along the bank

creek for a short distance. The thickness of these ; not less than 800 feet, and the dip like that of the ı above, about 50°–52° southeast.

estones of the Chazy and Trenton groups come next, 'ing a narrow valley between the chert ridge just l and the Clinton beds beyond.

lower limestones at least, are of Chazy age, judging characteristic fossil *Maclurea magna.*

dip corresponds with that of the beds below, and ckness of the limestones is not far from 350 feet.

Clinton strata are next encountered. These are standstones, with shales, and two or three layers of l fossiliferous ore. The rocks of this group form a efined ridge at this place, or rather, taken together e lower, cherty beds of the Sub-Carboniferous group, orm a ridge which is, however, not so marked as it es further northeast. The thickness of these beds reen 380 and 390 feet. The following is a more de- section.

inning below, next the limestones of the preceding the Clinton rocks are—

'hin-bedded yellowish sandstones, alternating with yellowish and greenish shales............155 feet.
'hick-bedded yellowish sandstones, alternat- ing with thinner strata of the same rock... 80 feet.
'hin-bedded, flaggy sandstones........... 10 feet.
ed ore, thickness not ascertained.
'hin-bedded, yellowish sandstones, with some heavier layers 2-3 feet thick............. 30 feet.
ed ore, exact thickness not determined.
leavy-bedded, yellowish or reddish sandstones 50 feet.
haly beds of greenish and yellowish colors 30 feet.
hales with thin-bedded sandstones........ 25 feet.

Total thickness..............above 380 feet.

enty-five or eighty feet of strata were not seen (cov- ith soil) between No. 9 and the first of the chert beds lescribed below. The Black Shale will probably be

found occupying part of this area, as it has been noticed a mile or two north of this section, between the Clinton and Sub-Carboniferous beds.

From the lower Mill down to the ridge of Millstone Grit, a fine opportunity is presented for the study of the Sub-Carboniferous rocks of this part of the Valley. They occupy an area of one-fourth of a mile or more across the strike, which would give not less than 800 feet vertical thickness. Although many of the beds are highly fossiliferous, the fossils have not as yet been studied sufficiently to enable me to give the equivalents in other states, of the beds observed here.

A section of the Sub-Carboniferous rocks at this place beginning below, at the lower mill, shows the following:

1. Heavy layers of bedded chert holding casts of crinoidal stems, and of brachiopod shells. These chert beds form the shoals upon which the dam has been built. The chert often resembles a porous friable sandstone from which calcareous matter has apparently been removed. In the chert, are subordinated beds of limestone, at least three: one of them a compact, gray, crystalline, crinoidal limestone; another, a dark blue fine grained rock.

Thickness of the cherty beds, about 200 feet.

2. Following these are at least 200 feet of calcareous strata, alternating with shales: some of these shales are black and quite fissile, others lighter colored and softer; all fossiliferous.

In this division there are two or three beds of limestone hard, compact and full of fossils; from beneath one of them issues a very fine bubbling spring, like those so common in the Knox Dolomite.

The great mass of the rocks, however, seems to be made up of impure argillaceous and sandy limestones, which weather into yellowish, brownish and reddish sandy rocks or shales—full of fossils as a general thing. These limestones, when fresh, are exceedingly hard and tough, and ring like a metal under the hammer. The dip of the beds wherever taken, was southeast, about 50°–55°.

I might add the following section of some of the beds of

above, given more in detail, which will serve to show of the characteristic features of the section. These are exposed in the bed of the creek below the mill, e, beginning with the lowest, (up stream):

Iard gray sandy calcareous rock, weathering into shales	30 feet.
lay shales, soft, light colored	30 feet.
mpure sandy limestone, laminated	8 feet.
oft, light colored clay shales	20 feet.
Ieavy bedded impure limestone, dark blue, and weathering into a sort of sandy rock..	40 feet.
lack fissile shales with numerous shells of brachiopods	40 feet.

---

old Iron Works stand in the gap cut by the waters ap's Creek, through the ridge of Millstone Grit, is here exposed in a very fine section. This ridge , going eastward, a narrow valley occupied by the and calcareous rocks of the upper part of the Sub-iferous section above. Beyond the iron works, east-is another narrow valley of Coal Measures shales, en a considerable ridge of sandssone of the same ion.

creek, like all others which rise in the valley, has ough Millstone Grit, and the hard rocks of the Coal res. It flows into Shades Creek at no great distance ere. The first or lowest of the beds of Cahaba coal in this vicinity, is I think some three or four miles southeast of the forge.

he opposite side of the railroad, and the northwest the anticlinal, we find the following:

n two and three-quarters to three miles, going the strike, the valley is underlaid by beds of Knox ite. Near the railroad, this formation has a narrow impure cherty calcareous rocks, and the rest of it st literally an ore bank. From many localities, the

limonite has been dug to supply the old forge and other furnaces. As was the case further southwest, near Greenpond, most of the hills about Tannehill are nothing but accumulations of limonite. The ore here lies, generally, upon beds of shaly impure limestone, having the usual strike northeast, and a dip towards the southeast of 75°-80°. It would be manifestly a tedious undertaking to enumerate all the localities of the occurrence of the ore banks, some of them, however, which were examined have some points of interest. In section 30, township 20, range 5, west, on the property of Mr. John Salmonds, are several extensive beds. In section 36, township 20, range 6, west, the association of limonite with the ferruginous sandstone already spoken of, was particularly noticed. The greater part of the loose surface fragments at this place, consisted of grains of quartz sand cemented together with limonite, which is occasionally a tolerably pure limonite with fibrous texture. The quartz grains are about the size of those of the Millstone Grit. Here, as well as at almost every other deposit in the vicinity, this ferruginous sandstone, in plates, pipes, hollow balls, &c., similar to those which almost universally cap the hills of the Drift formation further south, are found mingled with larger and smaller masses of pure concretionary limonite. I give these particulars on account of the bearing which they may have upon the origin of the limonite. The conclusion seems to be justified that whatever agencies have been at work in forming the ferruginous rocks of the Drift, have also been active in producing the similar iron rocks and ores of this formation. On this point, however, more will be said below.

At the McMath place, in section 30, township 20, range 5, west, a fine spring issues from beneath the Dolomite. In the northern part of the same section, an outcrop of Chazy limestone occurs, and a short distance further northwest a ridge of the Clinton sandstones, with two or three seams of red ore. This is followed by beds of chert, with well defined Sub-Carboniferous fossils, (the Black Shale was not seen exposed,) and about one-eighth of a mile

northwest of the chert beds, over a narrow valley of shaly rocks, probably also Sub-Carboniferous, we find the nearly vertical ledges of the Millstone Grit as usual, and beyond these the Warrior Coal Measures.

All these beds west of the anticlinal axis, dip towards the southeast, showing, as was the case further southwest, an inversion of the strata.

This occurrence of Chazy and Trenton, Clinton, Black Shale and Sub-Carboniferous beds in regular succession on both sides of the Knox Dolomite, may be seen at any cross section of the valley between Greenpond and Birmingham, and in all probability beyond, to the head of the valley.

In addition to the simple anticlinal here noticed, we find from Bucksville, northeastward, as far as Elyton, at least, in a more or less continuous ridge, a repetition of the *trio* of formations, Clinton, Black Shale and Sub-Carboniferous, and sometimes the upper beds of the Chazy and Trenton group. From Bucksville to S. 36, T. 19, R. 5, W. this doubled set of formations is found as a well defined ridge, known in the vicinity as *McShan Mountain.*

We propose now to give some details concerning this curious feature of the valley.

In Tuomey's first Report (p. 16), there is a section across the valley at Bucksville with a figure, which will serve to explain the positions of the formations as there exposed. I give below the table of the strata as given by him, together with the formations to which they belong, as ascertained by subsequent investigations.

a. b. Millstone Grit, and Coal Measures of the Warrior and Cahaba, on opposite sides of the valley.

c. Black clay slate, } *Sub-Carboniferous.*
d. Cherty rocks, }

e. Yellowish sandstone and iron ore. *Clinton.*

f. Siliceous rocks containing stems of Crinoidea. *Sub-Carboniferous.*

g. Sandstone containing iron ore. *Clinton.*

h. Limestone. *Chazy and Trenton.*

i. Magnesian Limestone. *Knox Dolomite.*

i(bis). Limestone, *(Chazy and Trenton,)* not given in Tuomey's section, but seen east of railroad at Tannehill Station.

k. Yellow sandstone. *Clinton.*

l. Ridge of Cherty rocks.
m. Sandstone.
n. Clay slate, underlying Millstone Grit.
} *Sub-Carboniferous.*

The section from *i.* to *n.* has already been described above, between the railroad and the Millstone Grit, at the old forge, and measurements given of the thickness of the strata. To the other half of the section, from *h.* to *c.*, I wish to call attention.

It will be seen that we have a repetition of the Clinton and Sub-Carboniferous rocks, *g.* and *f.*, and *e.*, *d.* and *c.* In Tuomey's figure, the Millstone Grit, *a.*, is represented as lying unconformably upon the slates and shales, *c.*, but I am inclined to think that in this particular, the section is faulty. In reality, the Millstone Grit stands on the western side of the valley, nearly vertical, or more correctly, it dips 85° or more towards the northwest, and the underlying Sub-Carboniferous shales have the same dip, which very gradually going westward, changes slightly to the southeast; at no point, however, being more than 5° from vertical, just as though the Millstone Grit, in the folding, had been pushed over *a little less* than the underlying rocks.

I do not think that Tuomey's explanation of the facts on p. 18 of his Report, viz: that the axis of the anticlinal is hidden beneath the Millstone Grit and Coal Measures, will hold good. The apparent unconformability of the Millstone Grit and the underlying rocks, exceedingly slight at most, can, I think, be better explained by assuming that the former being one of the upper beds of the great fold, and lying considerably to the westward of the axis of the fold, was less bent up than those beneath. Below this place, we find the Millstone Grit bent over still more, so as to slope the other way, *i. e.*, southeast, and the rocks of

the Coal Measures, which are undoubtedly conformably laid upon it, are seen a few hundred yards northwest nearly horizontal, or even dipping slightly northwest.

In a Report by Prof. J. P. Lesley, of Pennsylvania, upon the "Geological Structure of the Scott, Wise and Tazewell Counties, Virginia," there is described and figured a fault occurring in Abb's Valley, which I consider the counterpart of what may be seen in this valley, and the occurrence in such close proximity of the vertical sandstones of the Millstone Grit, and the horizontal strata of the immediately overlying Coal Measures is there explained in what seems to me the most convincing manner.

A precisely similar fault has already been noticed above, at Vance's Station, where it is exceedingly well defined. The same fault, with perhaps much less vertical displacement, occurs undoubtedly here, near Bucksville.

I am sorry that the means at my disposal are not sufficiently ample to enable me to reproduce the figure here; the reader is, therefore, referred to the paper by Prof. Lisley, above alluded to, and to the figure in Tuomey's Report, for a better understanding of what has been said.

As to the details of the doubled Clinton and Sub-Carboniferous beds at Bucksville, I can add the following: A few hundred yards northeast of the old McMath place, in S. 30, T. 20, R. 5, W., begins a ridge which, at its southwestern extremity, is covered with limonite of the Knox Dolomite. Near Bucksville, we find this ridge made up of the yellowish sandstones (holding beds of red iron ore) of the Clinton Group. Bucksville itself is near the junction of Knox Dolomite and Chazy, and the impure cherty dolomite of the former, with a large spring issuing from beneath, and the limestones of the latter can both be seen in the village and near the road. Back of the village, northwest, occurs the Clinton sandstone and iron ores, and at Bladoe's tan yard, the beds of chert of the Sub-Carboniferous with underlying Black Shale are shown in very good exposures in the bed of the branch. It seems that at this place there is even a local doubling of the Clinton

and Sub-Carboniferous interpolated beds, for we find two distinct outcrops of the red ore with bedded crinoidal chert between, in the immediate vicinity of the tan yard.

The exact details of this seeming anomaly, I was not able to get, and I merely mention this in passing. For our present purpose, it is sufficient to know that the trio, Clinton, Black Shale and Sub-Carboniferous, is found just back of Bucksville, at Bladoe's tan yard. All these rocks are nearly vertical, inclining 85 degrees, or more southeast, and this is to be remembered in connection with what will be said of their occurrence a few miles northeast of this point.

Now going northwest from Bladoe's, we pass in regular order (after the interpolated trio just described) the strata of Knox Dolomite, Chazy and Trenton, Clinton sandstones and red ore, (at this point called Red Mountain,) Sub-Carboniferous chert beds with crinoids, (Black Shale not actually observed,) and lastly, Millstone Grit.

It will be seen that this section agrees with Tuomey's, quoted above, except that the Millstone Grit is almost vertical, and not as represented in his section.

To the courtesy of Mr. Giles Edwards, I am indebted for the following analyses of the Red Ore from several localities near Tannehill. The ores are all from the western side of the valley.

	No. 1.	No. 2.
Metallic Iron	50.82	55.51
Silica, &c.	17.38	10.39
Sulphur	none	0.08
Phosphorus	0.09	0.06
Alumina	6.06	5.37
Manganese	none	0.44

No. 1 was made by Mr. J. B. Britton of Philadelphia; No. 2, by Dr. Thomas M. Drown, of Easton, Pa., both well known chemists. The percentage of phosphorus in these ores is exceedingly small.

Another specimen from S. 19, T. 20, R. 5w., by Mr. A. W. Kinzie, shows the following composition:

Sesquioxide of Iron........	71.93
Silica, &c.................	18.60
Water.....................	0.60
Alumina, &c..............	5.25
Phosphoric Acid.........	0.32 = 0.14 Phosphorus.
Carbonate of Lime.......	2.86
Metallic Iron.............	50.35
Phosphorus in iron........	0.28

These analyses show that the red ore on the western side of the valley is not infeiior to that on the east.

Analyses of red ores from the Eureka Mines will be found below.

Five or six miles northeast of Bucksville, in S. 36, T. 19, R. 5, W., near Mr. James Moore's, is the other end of this ridge of Clinton and Sub-Carboniferous beds, called *Mc-Shan Mountain.* The beds at this place are perfectly exposed, and a section of the northwestern side of the valley shows this order of things, viz.:

From the Knox Dolomite in the valley, going westward we come upon this ridge about a mile from the railroad. At the base of the ridge are the beds of Chazy & Trenton limestones with characteristic fossils: the beds dip 35 deg. northwest, and not southeast, as was the case at Bucksville. Going over the ridge we cross, in succession, (1) Clinton Sandstones and ore beds, making up the greater part of the mass of the ridge; the ore beds are at least two, and probably three in number; they have been tested in a few places, and yield a very excellent quality of ore; these, like the Chazy strata, dip northwest. (2) Heavy beds of chert holding crinoidal stems and other fossils of the Sub-Carboniferous: the intervening Black Shale was not observed, being covered probably with the *debris* of the other beds.

(3) A valley on the other side of the ridge in which the chert and sandy dolomite of the Quebec or Knox group appear, forming a small ridge; beyond which (4) the Chazy & Trenton limestone is found in ledges nearly vertical—but dipping 80°–85° southeast. The upper strata of these beds are highly fossiliferous and crystalline, streaked with reddish veins. This marble is very firm, and would, if polished, show the beautiful markings which have rendered the Tennessee marble so justly celebrated.

Westward of these beds are, (5) (6) and (7), the usual trio of formations making a ridge, here called the Red Mountain, viz.: Clinton, Black Shale, and Sub-Carboniferous. The upper shaly beds of the Sub-Carboniferous are found in a narrow valley between the Red Mountain and the vertical ledges of Millstone Grit.

Nothing could be clearer than the repetition of the Chazy, Clinton, and Sub-Carboniferous beds shown by this section. The northwest dip of the repeated beds here, and their vertical position, or slight southeast leaning further south at Bucksville, are points worthy of notice.

Above this point, towards Elyton, I have noticed the same duplication of the Clinton, &c., groups, but they are not found as a distinct ridge, but only as slight elevations. Thus, near McAdory's Mill, in S. 12, T. 19, R. 5, W., there is a double outcrop of the Red ore formation; and again a short distance southwest of Elyton. The Red Mountain proper, which is at these localities a well defined ridge, separated from the Millstone Grit Cliffs by a narrow valley underlaid by Sub-Carboniferous shales, is the one farthest west. It is separated from the duplicate Red Mountain by a valley containing Chazy limestones and Knox Dolomite.

It seems that from a short distance above Bucksville, to within four miles of Elyton, the Knox Dolomite, which below Bucksville has been seen to be the most widely spread of the formations, loses its importance to some extent, and we find the limestones of the Chazy & Trenton groups in almost vertical ledges filling up a large proportion of the valley. With the decrease in the extent of the Knox strata, goes also a decrease in the number and importance

of the limonite beds. They are *not absent* in this area, but they are comparatively unimportant by the side of those extraordinary accumulations of ore in the vicinity of Tannehill, Greenpond and Woodstock.

In S. 33, T. 18, R. 4, W., near Mr. John Smith's, is an ore bank, and from that point northeast to Birmingham, extends a continuous well defined ridge of chert of Knox Dolomite age. Upon this chert ridge is the reservoir of the Birmingham water works. It seems to be in the upper part of the Dolomite; for, crossing it west of Elyton, we descend at once into a valley of Trenton or Chazy limestone.

On the eastern side of the valley between Tannehill and Jonesborough, the road passes over chert of the Knox Dolomite, and a better road could not be desired. East of Jonesborough Station, after crossing a narrow belt of Knox Dolomite, the usual rocks of the Red Mountain are found, viz.: Chazy and Trenton, Clinton and Sub-Carboniferous, (the Black Shale not seen.) At this point the red ore is of good quality apparently, and in very great quantity.

At Old Jonesborough, the rough looking dolomite of the Quebec Group (Knox Dolomite) occurs in heavy ledges, dipping from 30 deg. to 35 deg. southeast. Between that and the station, is a low flat country with occasional outcrops of a laminated argillaceous limestone, resembling Chazy, but not yet determined satisfactorily. It lies between strata of undoubted Knox Dolomite on the west (at Old Jonesborough), and beds of the same group on the east, (between the station and the Red Mountain.)

A mile or less from Jonesborough Station, on the eastern edge of the valley, occurs a fine pond spring issuing from Knox Dolomite. A dam thrown up a few feet from the source of this spring gives sufficient fall for a mill wheel a short distance below.

Above Jonesborough, as has been intimated above, the center of the valley is occupied by the nearly vertical ledges of the Chazy limestone presumably, which are seen dipping both southeast and northwest. The geological structure of the valley at this point needs further investigation, since

the position of this limestone, in the midst of the valley with Knox Dolomite on each side of it, makes its precise relations a little obscure. Four miles southeast of Elyton may be seen the top of an anticlinal in this bedded, nearly vertical limestone, where the Dolomite seems to have been pushed up through it.

Above this point the larger part of the valley is occupied by the Dolomite, the chert ridge on the west, above alluded to, being a prominent feature. East of Elyton and Birmingham, the Red Mountain becomes a very well defined ridge, and much work has been done, in places in laying bare the red ore and raising it for shipment.

At the foot of the Red Mountain, on the western slope here, some of the finest specimens of concretionary chert yet found in Alabama have been collected. These specimens, some of which are many square feet in area, show a surface full of rounded protuberances, which are composed of chert in regular concentric layers. The outer layers have, in most cases, been worn or broken off, and the laminated shells, ball within ball, are beautifully displayed.

Going from Elyton to Oxmoor, we have the following section well displayed. (1) The clay beds of the Knox Dolomite, with a chert ridge of same formation near the Red Mountain. (2) At the base of the Red Mountain an outcrop of Chazy limestone. (3) The Red Mountain with the usual sandstones, shales and ore beds of the Clinton age. (4) In, or just beyond, the gap are the thick ledges of bedded chert of Sub-Carboniferous age, followed by a level space, probably underlaid by the shales of the same group. (5) Next, the Millstone Grit, which thus forms almost a part of the Red Mountain here, being separated from it by the narrow belt of Sub-Carboniferous shales mentioned. Descending from the Millstone Grit ridge, we come (6) into the valley of Shades Creek, here wholly within the Coal Measures, and not between the Red Mountain and Millstone Grit. Shades Valley is in the shales of the Cahaba Coal Measures, between the ridge of Millstone Grit on the west, and some precipitous bluffs of sandstone

on the east. These bluffs are the broken edges of carboniferous sandstones, which hold locally great numbers of impressions of *calamites* and other coal plants.

The Millstone Grit, from near Grace's Gap, has been used by Mr. Thomas in the coustruction of the hearth of the Oxmoor furnace, for which purpose it is most admirably adapted. The rock thus used, contains from 97 to 99 per cent. of silica.

A section of the Clinton strata, near Oxmoor, given below, has been made by Mr. L. S. Goodrich, of Birmingham. He recognizes two distinct deposits of ore, separated by about sixteen feet of ferruginous sandstones. The uppermost of these two deposits is about two feet thick, and is not known to hold any considerable bed of ore fit for use. No analysis of the ore from this part has been made. Below the sixteen feet of sandstone underlying the first deposit, comes the workable bed, made up of seven strata of ore interbedded with thin bands of shale.

The section, beginning at the top and descending, is:

1.	No. 1.	Ore	7	feet	3	inches
2.		Trace of shales and pebbles...				
3.	No. 2.	Ore	8	"		
4.		Shales	0	"	3	"
5.	No. 3.	Ore	2	"	3½	"
6.		Shale	0	"	0¾	"
7.	No. 4.	Ore	1	"	2	"
8.		Shale	0	"	1¼	"
9.	No. 5.	Ore	1	"	2½	"
10.		Shale	0	"	2	"
11.	No. 6.	Ore	0	"	11	"
12.		Shales	7	"	0	"
13.	No. 7.	Ore	1	"	3	"

Below these beds are forty to sixty feet of Argillaceous sandstones, followed by limestone.

This limestone is the Trenton or Chazy, which is found underlying the Red Mountain throughout the valley.

The ores from these seven beds were carefully selected by Mr. Goodrich, and analyses of them made by Dr. Otto Wuth, of Pittsburgh, Pa. These analyses I am enabled to give through the courtesy of Mr. Goodrich. The numbers correspond to the numbers of the ore beds of the section above.

Analyses of Red Ores, from Eureka Company's Mine, five miles below Birmingham, by Dr. Otto Wuth.

	No. 1.	No. 2.	No. 3.	No. 4.	No. 5.	No. 6.	No. 7.
Silicic Acid	16.31	31.62	32.04	31.83	31.16	31.91	16.73
Alumina	3.76	4.16	5.13	4.46	4.64	4.05	2.01
Peroxide of Iron	78.55	62.45	59.97	60.51	59.87	60.32	66.84
Lime	0.68	1.03	......	......	......	......	......
Magnesia	0.21	0.34	......	......	......	......	......
Phosphoric Acid	0.49	0.42	0.45	0.45	0.43	0.45	0.39
Sulphur	Trace.	......	......	......	......	......	......
Carbonate of Lime	......	......	......	......	......	......	......
Metallic Iron	54.98	43.71	41.98	42.36	41.91	42.22	46.79

The limestone of the underlying Trenton or Chazy formation has also been analyzed by the same chemist, as also a limestone from a bed in the Sub-Carboniferous series in Shades Valley.

The analyses show that these limestones are well adapted to serve as fluxes, especially No. 2, from the Sub-Carboniferous formation.

Analyses of Limestones, near Eureka Furnace, in Jefferson County, by Dr. Otto Wuth.

	No. 1.	No. 2.
Water	0.11	0.10
Organic Matter	0.07	0.06
Silicic Acid	2.13	5.32
Alumina	0.21	0.71
Peroxide of Iron	0.12	0.08
Carbonate of Lime	90.60	93.40
Carbonate of Magnesia	6.74	0.32
Phosphoric Acid	0.016	0.011

The success of the Oxmoor furnace, with coke as a fuel, has been already demonstrated. It was at this place, under the superintendence of Mr. L. S. Goodrich, that the first coke iron made in Alabama, was turned out. The coke first used here was made, I believe, from coal mined from the Gould Seam, and afterwards from the Wadsworth seam at Helena.

ECONOMIC MATERIALS.

COAL.—The coal fields of the Warrior and the Cahaba bound the valley on either side, and their distance apart is, below Birmingham, never greater than seven or eight miles. The line of the Alabama and Chattanooga railroad does not pass into the coal area on either side until below Smallwood's Station, it enters the Warrior field, through which it passes thence to Tuscaloosa. Near Clements' Station, as will be seen above, many openings have been made for coal, and from that point on to Kennedale, seven miles from Tuscaloosa, are several coal stations. Nothing but the unsettled condition of the affairs of this road has prevented an extensive business in the mining of coal along this portion of the road.

FIRE-PROOF MATERIALS.—At Bibbville is a bed of clay and sand, which is made into fire bricks.

The fire brick manufactory of Mr. Flournoy has already been mentioned in the details above. Besides the brick for ordinary grate backs, this establishment has furnished bricks for the stacks of smelting furnaces at various places, and for the puddling furnaces at Helena.

The Millstone Grit being almost pure quartz, is one of the best of fire proof materials. Some varieties of it are of course better suited to the purpose than others. It is near the A. & C. railroad in many localities, *e. g.* Vance's, Tannehill, &c., and on the South and North railroad, at Grace's Gap. This rock has been used at the Oxmoor furnace for the lining of the hearth, and for this purpose it is unequalled.

MILLSTONES.—The Millstone Grit which bounds the valley on each side, has its name from the almost universal use made of it, wherever it occurs, the world over. There are several localities on the borders of the valley where the rock has been extensively quarried for millstones, and unfinished or broken millstones are not unfrequently found in riding over the rocky ledges.

LENTICULAR OR FOSSILIFEROUS RED IRON ORE.—The "Red Mountain," is a name which has long been current in Alabama. It is applied to the ridges of Clinton Sandstones holding beds of red iron ore, which are found on both sides of the valley, and which have been traced with very little interruption from Pratts' Ferry, on the Cahaba, above Centerville, to the Georgia line, and beyond that into other States. In Tennessee the Dyestone ridges are the equivalents of our Red Mountain.

The quality and amount of the ore vary from place to place along these outcrops. Sometimes the admixture of siliceous material is too large; again, the ore is exceedingly pure, as may be seen from analyses given.

The ore banks of the Oxmoor furnace have been, perhaps, the best tested and explored of any in the State, and the result shows that when properly selected this ore rivals the brown ore. The quality of the iron produced at the Oxmoor furnace is now well known.

In this connection, I may once more call attention to the fact that the group of strata holding the red ore, is *duplicated* on the western side of the valley, from Bucksville, nearly to Elyton, and that the interpolated Red Mountain ridge, holds in some places, at least, where personally visited, some very excellent ore. The McShan Mountain, as this ridge is called, in the lower part of its course, is not more than a mile from the railroad, at most places.

As to the *extent* of the beds, here sliced off from the main Red Mountain, future careful explorations and measurements are required to give that accurately, and future investigations will probably, also, show exactly how such

a long strip came to be cut off from the main, and dropped or slided down to its present position.

Limonite or Brown Iron Ore.

The Knox Dolomite of the Lower Silurian, which underlies the greater part of this valley, is here, as at other points in the State, the limonite-bearing formation. Wherever it is most widely spread, there we may look for the greatest accumulations of limonite. Mere superficial extent, however, of the Knox Dolomite does not appear to be the only condition favorable to large accumulations of limonite. We saw in Talladega county, and elsewhere (Report for 1875,) that the most extensive ore-banks were generally found between the mountain ranges of Potsdam Sandstone on the west, and the Metamorphic area on the east. In other words, where the disturbances, uplifts, &c., have been the greatest, the ore-banks are most numerous and extensive. So here, the limonite banks are most abundant where we find evidences of the greatest amount of displacement of the strata.

The commonly received explanation of the origin of the limonite, viz., that it is the result of the decomposition of ferruginous limestones and dolomites, by which the calcareous portions have been gradually removed, whilst the iron collecting together, in concretionary masses, has been deposited in beds of varying extent, near the site once occupied by the original rock, seems to hold good for the ore banks, so far as they have yet been examined in Alabama.

In some parts of this valley there is evidence to show that the Knox Dolomite, and overlying rocks have been pushed up into an anticlinal fold not only of great *vertical* height, but, also, *closely pressed* together, so that the strata all stand nearly perpendicular, or all dip in the same direction. The subsequent decomposition of this great vertical thickness of ferruginous limestones, has left correspondingly large accumulations of limonite. This appears to have been the case in the lower part of the valley, be-

low Jonesborough. Above that, however, to Elyton, at least, the vertical height of the anticlinal seems to have been much less, (see details above,) and we find in this area only a few ore-banks, and these, comparatively small.

Whilst the Knox Dolomite of the Lower Silurian appears to be the original source of most of the brown ore in Alabama, the formation of the *ore-banks*, as now observed, must be ascribed to a much later period. And, in this connection, it seems to me that something may be learned from the association of Drift deposits with beds of limonite in many localities.

In Bibb county, Talladega county, and in this valley, many instances have been noticed where a ferruginous sandstone or conglomerate, formed by the cementing together by limonite, of grains of sand or pebbles of quartz, is associated with masses of limonite quite pure. The association of the two is frequently so intimate that upon one and the same specimen both are sometimes found. This ferruginous sandstone in flat layers, pipes, hollow spheres, &c., is one of the most common occurrences in the Drift, and in the cases just alluded to, other materials of the Drift, such as rolled pebbles, beds of sand, &c., are also, associated with the sandstones and limonites.

Whatever agencies, therefore, have been active in forming the ferruginous sandstones and conglomerates usually ascribed to the Drift, have also been instrumental in forming part, at least, of the limonite with which they are so intimately associated.

COOSA COAL FIELD, AND ADJACENT FORMATIONS.

GENERAL CONSIDERATIONS.

By a reference to Prof. Tuomey's Map, it will be seen that the Coosa Coal Field, as there laid down, extends no further west than the line between Ranges 1, east, and 1, west, and no further south than the upper half of Township 20.

During the summer of 1875, I noticed in several places, much further south and west than the points above mentioned, the occurrence of Sub-Carboniferous beds, as well as of sandstones and slates, which I could refer to no other formation than that of the Coal Measures.

During the past summer this section of the State was again examined, and the limits (towards the west and south,) of the Coosa Coal Field, established with some degree of accuracy from near Helena, southward to where the lower formations are covered by Drift. The map accompanying this report will show the line thus traced out.

Before going into local details it may be well to give a general section, across the strike of the strata, passing through Helena, from the Warrior Coal Field across Roup's Valley, through the Cahaba Field into that of the Coosa. In this way, perhaps, a very good general idea of the relations to each other, of these three Coal Fields may be given.

Beginning on the west with the Coal Measures of the Warrior, and going southeast, we descend, *geologically*

speaking, through the Millstone Grit, Sub-Carboniferous, Black Shale, Clinton, Trenton, and Chazy, to the Knox Dolomite, which is the lowest formation exposed in the anticlinal valley between the two fields; then *geologically ascending*, through the same series, we reach the Coal Measures of the Cahaba. Crossing this field with its numerous plications, but with its strata generally dipping southeast, we find at Helena, a fault by which the Coal Measures are cut off, and the sandstones of the Knox Group—equivalent in all probability to the Calciferous Sandstone of the northern geologists,—brought up to their level. From this fault we cross, going southeast, the Sandstone, Shale, and Dolomite of the Knox Group, then Chazy and Trenton limestones, and immediately following these, so far as has yet been made out, the chert beds and Shales of the Sub-Carboniferous formation, the Millstone Grit, and Coal Measures of the Coosa field.

Thus, whilst the Warrior and Cahaba fields are separated, in this section of the State, by a narrow anticlinal valley, with the Knox Dolomite as the lowest formation exposed, the Cahaba measures are cut off on the east by a fault bringing Knox sandstone up to the Coal; and another point to be noted, is the seeming lack of all the Upper Silurian beds, beneath the Coosa field, whilst beneath the Warrior and Cahaba fields, only a few miles westward, these Upper Silurian beds are found exceedingly well developed in the Red Mountain, geologically below the Coal Measures both of the Warrior and the Cahaba. The thickness of the Clinton strata as measured in Roup's valley at one point, is not less than 400 feet, and this may be considered as below the average thickness, for further north, the Red Mountain becomes a very well defined ridge.

This complete thinning out of Upper Silurian beds from a thickness of 400 feet and upwards, in the short distance of ten to fifteen miles across the Cahaba fields in the vicinity of Helena, is an interesting fact. Whether the same conditions hold northeastward of Helena, I am not yet able

to say, but from information derived from others, I am inclined to think that they do.

As to the economical value of the three hundred square miles and upwards, of territory, thus found to belong to the Coal Measures, little can be said as yet. The fact, that workable beds of coal have not yet been laid bare in this area, and the occurrence in the midst of this coal field of the limestones of the underlying Sub-Carboniferous formation, would seem to speak against any great thickness of coal bearing rocks, thus far towards the southwest, still the field must be more thoroughly investigated before certain knowledge of its capabilities can be obtained.

With these preliminary general observations we may pass on to the local details.

DETAILS.

1. Quebec, Chazy, and Trenton Formations.

At Helena the strata of Knox Sandstone and Knox Shale, on the east side of the fault by which the former has been raised to the level of the Coal Measures, are very well exposed along the South & North Alabama Railroad, and I am able to give some additional details as to thickness of the beds, &c.

The dip of the beds varies from about 62° next to the Coal Measures to 52° at the top of the Shale; these two formations show here, an aggregate verticle thickness of from 1,000 to 1,100 feet; the line of demarcation between the two, it is impossible to draw.

A section of these beds shows the following, beginning geologically below, next to the line of fault:

(1.) Sandstones, thick and thin bedded, interstratified with the gray, green, buff, brown, and chocolate colored shales, which are so characteristic of the lower parts of the Knox group, about 270 feet.

(2.) A bed of gray sandy dolomite, 10–15 feet.

(3.) Two or three heavy beds of hard gray sandstones,

forming the knoll upon which the office of the Central Iron Works stands, and forming also the greater part of the shoals upon which the dam has been built, say 50-60 feet.

(4.) Alternating beds of dolomite and shale, with perhaps some sandstone layers, mostly covered by surface soil, but showing exposed surfaces of dolomite in many places between the office and the Rolling Mill, say 150 feet.

(5.) From this point to the bottom of the Knox Dolomite which overlies the Shale, there is a succession of thin beds of calcareous sandstones and the usual handsomely colored characteristic shales, about 500 feet.

In No. (5) of the above section and about 180 feet below the top of the Shale in one of the ledges of calcareous sandstone, I found several fragments of trilobites, which have not yet been identified. The rock from which they were taken, upon a fresh fracture resembles a hard compact blue limestone, but upon a weathered surface it looks like a buff colored sandstone. Most of the thick layers in this subdivision, when a fresh fragment is broken, resemble limestones more than they do sandstones. At the outcrops however, the calcareous matter has usually been weathered out, and they present only the sandy remnant.

For the estimation of the thickness of the Knox Dolomite, just overlying the Shale near Helena, I have not the data. Crossing it, however, in the direction of the dip, *i. e.* southeast, we find about 400 yards of country underlaid by rough, sandy, dolomite, and upon that an enormous accumulation of cherty beds, about a mile across, forming a well defined chert ridge which may be traced without interruption, marking the uppermost part of the Knox Dolomite, from near Helena southward by Alexander's Mill, till it is lost under the Drift below Montevallo.

East of this cherty ridge is found a narrow valley of Chazy and Trenton limestones, and then the ridge formed by the bedded fossiliferous chert of the Sub-Carboniferous formation.

An inspection of the map will show the position of the valley of Chazy and Trenton limestone which lies between

the chert ridge of the upper part of the Knox Dolomite on the west, and another chert ridge of Sub-Carboniferous age on the east.

These three formations are found in their regular order all the way southward to where they are covered by the Drift.

Some local details of these three groups of strata will come properly at this place, and in giving the details I shall begin with the lowest and describe them in ascending order.

In the Report for 1875, I described the Dolomite where it adjoined the Cahaba CoalMeasures between Montevallo and Helena. At this time, therefore, I shall speak only of the upper (eastern) part of the Dolomite which is so well characterized by accumulations of chert which make a well defined piney woods ridge from Helena to below Montevallo.

West of the limestone valley at Siluria, this ridge is seen back of Dr. Tichenor's place, and at points near Siluria, some beds of brown iron ore have been discovered, but I have seen no analyses of the ore.

South of Mr. Holt's Lime Kiln and near Elliottsville, the chert turns eastward to Whiting, which is on its eastern edge. Elliottsville is upon this cherty portion of the Knox Dolomite, and at Warren's Mill, section 25, township 21, range 3, west, there is a very large funnel shaped depression, or lime sink, from which the water is pumped for the engine.

Below Whiting, on the edge of the Dolomite, considerable search has been made for workable beds of limonite. Analyses of ore from this vicinity were given in my Report for 1875.

Going southward from Elliottsville on the Montevallo road, the way is over the cherty beds and through piney woods to Mr. Moore's, in S. 35, T. 21, R. 3, W., where the red lands of a lower subdivision of the Dolomite are entered. These red lands are found continuously then southward to Montevallo, with the exception that a strip of Knox

Sandstone and Shale is found with northeast strike and southeast dip, apparently thrust up through the Dolomite. This strip (which will be more particularly described below) terminates abruptly near Mrs. Denson's, S. 2, T. 22, R. 3, W., no trace of it being found much to the northeast of this point.

If from Moore's we turn eastward by the Columbiana road, we come, about S. 36, T. 21, R. 2, W., upon the chert again, and it is found making a considerable ridge southward by Alexander's Mill, where it is also well displayed.

In going from Montevallo towards Calera, a ridge, or rather, a succession of ridges of this chert are crossed soon after leaving town, and the huge concretionary masses of the chert which have either been rolled aside in working the road, or have been left partially exposed in the road, have no doubt left a vivid impression upon every one who has driven over this way.

Spring Creek, and some other tributaries of Shoal Creek, rise on the western side of the chert, and do not break through it, but are turned southwestward below Montevallo to flow into the Little Cahaba.

South of Montevallo, the lower formations are almost entirely obliterated by the sand and pebble beds of the Drift, which cover every thing for many miles.

Returning now to Siluria, we find, east of the chert, a narrow valley in which the projecting edges of the strata of Chazy and Trenton limestones are seen like a series of low walls running parallel with the course of the valley.

Here, as at many other points where it occurs, the limestone is much used for lime burning. Maj. Wagner's and Mr. T. G. Holt's kilns, at Siluria, Mr. Reynolds' at Whiting, and Dr. Hale's, near Montevallo, are all located upon this belt, and the lime made at these points is well known in the market.

Below Siluria this belt turns eastward, then southward, and in township 22, southwestward, as shown by the map.

Buck Creek has its principal sources in this limestone cove east of Whiting, whence it follows the valley westward and northward to Pelham, where it breaks through Knox Dolomite, Shale and Sandstone, into the Cahaba coal fields, and flows into the Cahaba river. The creek makes between Siluria and Whiting, an S-shaped curve corresponding to the contour of the limestone valley, or to the chert ridge of Knox Dolomite on one side, and the chert ridge of Sub-Carboniferous on the other.

In the neighborhood of Calera is found an isolated patch of this limestone, apparently cut off from the western belt just described. It is probable, however, that the two areas have been continuous, but this continuity is hidden by the overlying Drift, south of the Selma, Rome & Dalton Railroad. If we follow the edge of the limestone formation, where it joins the Sub-Carboniferous, we find the beds of the former always dipping at considerable angles under those of the latter.

Thus, near Dr. Hale's Lime Kiln, the limestone dips southeast under the Sub-Carboniferous chert, cut through by the railroad at the "Gap of the Mountain." Crossing then going eastward, the narrow strip of Sub-Carboniferous rocks and Coal Measures, we come into the Calera limestone, which now dips northwest, north, and around to the east, always *under* the crescent-shaped ridge of Sub-Carboniferous rocks, that bounds the northern part of the Calera area. South of the Selma, Rome & Dalton Railroad the outcroppings of limestone, both of the Calera patch and of the western belt, may be followed for a mile or two, and then they are hidden by the Drift, but the numerous lime-sinks and depressions, let us infer the presence of the limestone beneath the Drift for several miles further south.

From Squire Whatley of Calera, I obtain the information that the limestone is exposed about seven miles southeast of Montevallo on the Montgomery road; this is probably the continuation of the western belt of the limestone below Dr. Hale's. Again it comes to the surface in SS. 15 and 22 of T. 24, R. 13, E., of the lower survey.

Economical Products.—Throughout this entire area of Chazy & Trenton rocks there are many beds of limestone which are shown by analysis to be almost pure carbonate of lime, and it is, therefore, not surprising that the Shelby lime ranks with the very best. Aside from the lime, I know of no other useful material to be derived from this formation.

I should mention, however, that *heavy spar*, or sulphate of baryta, is found in many places in the limestone, and sometimes quite pure and white, and in considerable quantity. Thus, east and north of Whiting, are several well known occurrences. This mineral is often ground up and mixed with white lead in several proportions, giving the paints known as Venice White, Hamburg White, and Dutch White.

The *limonites* of the Knox group have already been mentioned.

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2. Sub-Carboniferous and Coal Measures.

East of Pelham is seen a sharp ridge running nearly north and south. This ridge is formed chiefly by the heavy beds of crinoidal chert of the Sub-Carboniferous formation. It may be traced southward to Siluria, where the railroad passes through a gap in it; below Siluria it bends around towards the east, and is cut again by the railroad at Bragg's Tank, in S. 12, T. 21, R. 3, W. From Bragg's Tank it curves northward, eastward, and then southward, enclosing all of section 8, and parts of 7 and 9, of T. 21, R. 2, W., in a sort of cove which is underlaid by the limestones already described. It continues its southern trend to the lower part of township 21, where Camp Branch cuts through it. Below this, under the name of *Harkins' Ridge*, it is cut again by the railroad about S. 9, T. 22, R. 2, W.; and it may be followed thence sothwestward, by Mr. Sentill's and Squire Whatley's, to the "Gap of the Mountain," where it is cut by the Selma, Rome & Dalton Railroad. Below this it is covered almost entirely by the Drift. The

general direction of the dip of the strata is east or southeast, always *away* from the limestone valley.

Where the ridge makes a curve, the direction of the dip of course varies, but it is always *towards* the coal measures and *away* from the limestone. The occurrence at Calera will be mentioned below, after giving some details of the region just traced out.

Near Siluria, east of the cherty ridge, shales of yellowish and blackish colors, form a narrow valley of about half a mile in width, and then follow the abrupt and broken edges of the Millstone Grit, here as elsewhere, a purely siliceous rock, with quartz grains or pebbles. The ledges of Millstone Grit form a well defined ridge following all the sinuosities of the chert ridge, and at the distance of about a quarter or half mile from it.

At Patton's Mill, S. 6, T. 21, R. 2, W., the ledges of the Grit strike N. 60° E. and dip N. W. at an angle of 54°. A small tributary of Buck Creek rising in the Coal Measures, breaks through the Conglomerate here, making a very narrow gorge, the sides of which are so close together that a dam of ten feet length is sufficient to confine the water for an overshot wheel 35 feet in diameter, a few yards below.

There are few scenes more worthy of the pencil of an artist than those found wherever the Millstone Grit has been broken through by a comparatively insignificant branch. The tough, hard rock, yields only enough to allow the water to pass through, making deep, narrow gorges, with towering. precipitous cliffs of sandstone on each side.

In this tributary of Buck Creek, and several others further north, the waters rise in the Coal Measures of the Coosa field, break out into the limestone valley and across it into the Coal Measures of the Cahaba.

Beyond the ledges of Millstone Grit are the shales and sandstones of the Coal Measures extending eastward nearly to the Coosa river.

The sharp curve made by the Sub-Carboniferous chert

between Siluria and Bragg's Tank, is repeated by the Millstone Grit, and we find a sharp turn in the direction of the ledge, in the corner of SS. 1 and 12, of T. 21, R. 3, W., and S. 6 and 7, T. 21, R. 2, W. This doubling back of the conglomerate forms quite a conspicuous knob at the point indicated. So also the sandstones of the Coal Measures where they turn at a corresponding sharp angle, form a high bluff of several hundred feet, known as the Stony Butte. This is near the northeast corner of S. 6, T. 21, R. 2, W.

I am informed by Dr. Tichenor that coal has been reported as found in this vicinity, about four or five miles from Siluria.

East of Whiting, Camp Branch has its source in the limestone cove spoken of, flows south parallel to the chert ridge to the lower part of the township, where it turns abruptly east, cutting through the ridge, flowing through the Coal Measures into the Waxahatchee.

The slates exposed in the bed of Camp Branch near Shelby Springs, were mentioned in my Report for 1875, but the geological position of them was not entirely evident.

It is plain however, now, that they must be referred to the Coal Measures. The coal measures between the Sub-Carboniferous ridge east of Whiting and Columbiana, were partially examined last year and many points of interest observed.

The Millstone Grit is found in its place about one quarter of a mile east of the chert ridge, then follow the sandstones and shales of the Coal Measures to Columbiana, with an exception presently to be mentioned. Characteristic of nearly all the fragments of sandstone in this area, are the brilliant crystals of quartz which cover some of the surfaces. The crystals are generally quite small.

On pages 121 and 122 of my Report for 1875, will be found conclusions reached from observations of last year, as to the extent of the Coosa coal fields towards the south and southwest, and it will be seen that the explorations of

this year, have shown that my conjectures were perfectly correct.

A strip of limestone, considered by Prof. Worthen to be of the age of the Chester Limestone, is found running through the midst of the coal field. The manner in which this underlying limestone has been brought to light through the coal measures, whether by denudation or by a fault, will be an important point to settle in forming an estimate of the probable thickness of coal bearing rocks in this field.

In township 22, below where Camp Branch cuts through it, the chert ridge is known as *Harkin's Ridge*, and its course may be seen by a reference to the map.

In S. 8, T. 22, R. 2, W., it turns abruptly, and does so, not by a continuous curve, but in a broken one, thus:

This formation of a curve by broken lines will explain the recurrence in several alternations with each other, of Sub-Carboniferous chert and Chazy limestone, noticed last year between Montevallo and Calera.

An outcrop of Millstone Grit was observed about one mile north of the S. R. & D. R. R., near this place.

If we go from the "Gap of the Mountain," where the R. R. cuts the Sub-Carboniferous ridge, towards Calera, we cross a synclinal of Coal Measures, about one mile wide, underlaid on each side by Sub-Carboniferous Chert and Chazy and Trenton Limestone.

The Chert ridge on the eastern side of this little synclinal, curves (in a broken line as described above) around towards the north and east just back of Mr. Thompson's house, then southeast by Mr. Dare's new limekiln, and finally south and southwest, enclosing thus an area of limestone about two and a half miles from east to west, and about two from north to south; the southern limit of it being, as already said, obscured by the Drift.

Immediately beyond the Sub-Carboniferous ridge are

the shales and sandstones of the Coal Measures, and a thin seam of coal about two inches in thickness, was cut through in digging a well in S. 16, T. 22, R. 2, W. (near the middle of the section). This upon the authority of Mr. Dare.

Near Mr. Thompson's house, a quarry exposes some beds of dark colored argillaceous limestone, which is fossiliferous, but from which no well defined forms have been obtained. This limestone, which has been much used as a building stone for culverts, &c., lies under about eight or ten feet of black fissile shales. The dip of the beds is towards the northeast and the strike a little northwest. They are undoubtedly Sub-Carboniferous beds, but their position, whether above or below the chert beds, I can not give with certainty. At this point they seem to be *under* the chert.

From Mr. Dare's Kiln, the chert ridge has a southwesterly direction and can be traced several miles before it is hidden by the Drift.

East of this point are found the sandstones and shales of the Coosa Coal Measures on to near Columbiana, except where interrupted by the limestone exposure near Shelby Springs.

The geological age of the slates of the Buxahatchee and neighboring streams, is thus determined with a great degree of probability, if not with certainty. I have no doubt but that they are slates of the Coal Measures, or perhaps in some cases, of underlying Sub-Carboniferous age. The close proximity of an area of metamorphic action, may serve to account for the toughness and fissile character of these slates, which have probably been themselves partially metamorphosed.

Economic Materials.—Some of the impure limestone beds of the Sub-Carboniferous group, have been tested as to their fitness as material for hydraulic lime, and in the case of the limestone occurring near Siluria, it has been found to answer. Satisfactory tests on a large scale have not yet been made.

LIMONITE.—Beds of brown iron ore or limonite, have been noticed as occurring frequently upon the ridges of chert of the Sub-Carboniferous group; but so far as the analyses go the ore is worthless. In the first place it is not likely to occur in any considerable quantity, then it is too frequently largely contaminated with chert, which often has the appearance of chalk (being white and pulverulent), but the gritty feel when it is rubbed between the fingers or between the teeth, will betray it: and lastly, the per centage of phosphorus is generally unusually large. In one specimen which was analyzed by me, it reached the figure of 4 per cent., equivalent to 9 per cent. of Phosphoric acid. Other samples gave 1.9 and 2.5 per cent. Phosphorus.

Unless, therefore, the ore has been analyzed and proven to be good, a purchase would be, to say the least, a risk.

COAL.—Of the quantity or amount of the coal contained in this part of the Coosa fields, very little can be said as yet. The occurrence of coal in this region has undoubtedly been noticed, but no workable beds of it have yet been found.

Under the beds of chert in the lower part of the Sub-Carboniferous formation which lines the Coosa coal field, a bed of black or dark blue fissile shales, like many in the coal measures, is constantly found. At the Gap of the Mountain they are well shown in contact with the overlying chert beds. The thickness of the bed is not less than ten feet. Underneath a similar bed, perhaps the same, at Mr. Thompson's house at Calera, is found a dark blue argillaceous limestone.

SUMMARY OF CHEMICAL ANALYSES.

The appended summary, in tabular form, of the chemical analyses appearing in the body of the report, will be found convenient for reference.

The analyses are from various, but always trustworthy sources.

Table I. Iron Ores.

BROWN ORES, OR LIMONITES.

	No. 1.	No. 2.	No. 3.	No. 4.	No. 5.	No, 6.	No. 7.
Water..................	......	12.51	13.09	8.55	11.35	12.14	11.55
Insoluble, Silica, &c.....	9.80	3.28	3.10	34.03	2.46	12.16	2.98
Sesquioxide of Iron.....	......	83.89	84.25	57.46	84.46	75.04	82.63
Sulphur................	none.	......	......	......	0.14	0.14	0.14
Phosphoric Acid.........	0.31	trace.	trace.	trace.	0.58	0.00	trace.
Alumina	3.75	......	......	....	0.91	0.30	1.39
Manganese..............	none.	......	....	......	0.33	0.00	1.02
Metallic Iron.......	50.68	58.75	59.00	40.24	59.15	52.55	58.01
Phosphorus.........	0.12	trace.	trace.	trace.	0.25	none.	trace.

No. 1. Brown ore from head of Caffee's Branch. Analyzed by Dr. T. M. Drown.

No. 2. Brown Ore, from Edward's Bank, near Greenpond. Analyzed by Prof. Roepper.

No. 3. Brown Ore, from another part of same property as No. 2. Same analyst.

No. 4. Brown Ore, locality same as Nos. 2 and 3. Same analyst.

No. 5. Brown Ore, near Woodstock Station, Tuscaloosa county. Analyst, Prof. N. T. Lupton.

No. 6. Brown Ore, near Woodstock Station, Tuscaloosa county. Same analyst.

No. 7. Brown Ore, near Woodstock Station, Tuscaloosa county. Same analyst.

Table II. Iron Ores.

RED HEMATITES.

	No. 1	No. 2	No. 3	No. 4	No. 5	No. 6	No. 7	No. 8	No. 9	No. 10
Water	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.60
Silica, &c	16.31	31.62	32.04	31.83	31.16	31.91	16.73	17.38	10.39	18.60
Alumina	3.76	4.14	5.13	4.46	4.64	4.05	2.01	6.06	5.37	5.25
Sesquioxide of Iron	78.55	62.45	59.97	60.51	59.87	60.32	66.84	.....	.....	71.93
Lime	0.68	1.03	.....	.....	.....	.....	.....	.....	.....	.....
Carbonate of Lime	.....	.....	.....	.....	.....	.....	.....	.....	.....	2.86
Magnesia	0.21	0.34	.....	.....	.....	.....	.....	.....	.....	.....
Phosphoric Acid	0.49	0.42	0.45	0.45	0.43	0.45	0.38	.....	.....	0.32
Sulphur	trace	.....	.....	.....	.....	.....	.....	none	0.08	.....
Metallic Iron	54.98	43.71	41.98	42.36	41.91	42.22	46.79	50.82	55.51	50.35
Phosphorus	.....	.....	.....	.....	.....	.....	.....	0.09	0.06	0.28

Nos. 1 to 7 inclusive, are Red ores from seven distinct beds of ore worked at the Eureka Company's Mine, near Birmingham. Analyst, Dr. Otto Wuth, of Pittsburgh.

No. 8. Red ore from the western side of the valley, near Tannehill. Analyst, Mr. J. B. Britton, of Philadelphia.

No. 9. Red ore from near the locality of No. 8. Analyst, Dr. T. M. Drown, of Easton, Pa.

No. 10. Red ore from S. 19, T. 20, R. 5, west, western side of the valley, near Greenpond. Analyst, Mr. A. W. Kinzie.

Table III. Limestones.

	No. 1.	No. 2.
Water	0.11	0.10
Organic Matter	0.07	0.06
Silicic Acid	2.13	5.32
Alumina	0.21	0.71
Sesquioxide of Iron	0.12	0.08
Carbonate of Lime	90.60	93.40
Carbonate of Magnesia	6.74	0.32
Phosphoric Acid	0.016	0.011

No. 1. Trenton Limestone, near Eureka mines, six miles from Birmingham. Analyst, Dr. Otto Wuth.

No. 2. Sub-Carboniferous Limestone, near Eureka Mines. Analyst, Dr. Otto Wuth.

FAUNA OF ALABAMA.

FRESH WATER AND LAND SHELLS.

ere is no State in the Union that affords a more di-
ied Molluscan Fauna than is found within the limits
abama. While exhibiting no marked superiority in
umber of species that are classed as Land Shells, and
oly displaying a meager list of aquatic pulmonates, it
narkably rich in fresh water bivalves (Unionidæ), and
operculate class of aquatic univalves, chiefly of the
y Melanidæ.

e list of species here presented is compiled from vari-
ources, chiefly the writings of Isaac Lea, L. L. D.,
has written more on the fresh water shells of North
ica than all other original writers together. The
lations and writings of Mr. W. G. Binney have af-
d much aid in compiling the pulmonate species. The
gs of Thomas Say and other distinguished American
nologists, have also been consulted.

e verification of facts relative to local and geograph-
istribution, has been greatly aided by material pre-
d by various gentlemen, who have, at different times,
ted shells in various parts of Alabama. Among the
emen to whom the greatest credit is due for speci-
and notes on Geographical Distribution, may be
oned Dr. E. R. Showalter, of Mobile, formerly of
ntown, who, prior to 1861, was largely interested in
ing to light many species which were previously un-
n. Later, Mr. Truman H. Aldrich, of Montevallo,

formerly of Selma, has taken up the subject and afforded much valuable information. At Tuscumbia, L. B. Thornton, Esq., and Mr. B. Pybas have made many useful discoveries. At Tuscaloosa, Dr. Eugene A. Smith, State Geologist of Alabama, has recently made additions to the subject. There are, no doubt, portions of the State that have not been explored, and very likely unknown species remain to be brought to light. The shells of the Chattahoochee River, and of streams in the eastern part of Alabama were very diligently studied prior to 1861, by Dr. Hugh M. Neisler, Mr. Garrett Hallenbeck and Wm. Gesner, at Columbus, Ga. The late Rt. Rev. Stephen Elliott, of Savannah, Ga., also materially aided in contributions to our knowledge of the shells of Alabama, Georgia and other Southern States. A study of the shells of Alabama necessarily involves a portion of the fauna of Georgia and other States on the borders of Alabama. To isolate them in cases in which there is a doubt as to the extent of Geographical Distribution is sometimes difficult. Species may have been credited to Alabama that may hereafter not be verified. Unquestionably a few species that were referred to Georgia at the time they were described, will hereafter also be found in Alabama, though not so recorded here.

The fascinating character of the study of this branch of Natural History will assuredly bring new collectors into the field, and bring to light many new facts which at some future time will make a revision of the present list necessary.

JAMES LEWIS.

Mohawk, N. Y., October 24th, 1876.

Shell-bearing Mollusca of Alabama.

LAMELLIBRANCHIATA.

CONCHIFERA.

Family Unionidæ.

GENUS UNIO, *Brug.*

abacus, *Haldeman*. Tennessee drainage.
acutissimus, *Lea*. Alabama river; Coosa river.
Æsopus, *Green*. Tennessee drainage.
alatus, *Say*. " "
altilis, *Conrad*. Alabama river.
amœnus, *Lea*. Tennessee drainage.
Andersonensis, *Lea*. " "
Anodontoides, *Lea*. Chattahoochee and Alabama rivers; Bogue Chitto Creek.
appressus, *Lea*. Tennessee drainage.
aquilus, *Lea*. Chattahoochee or its tributaries.
arcæformis, *Lea*. Tennessee drainage.
arctatus, *Con*. Black Warrior, Coosa and Cahawba rivers.
arcus, *Con*. Alabama river.
argenteus, *Lea*. Tennessee drainage.
asper, *Lea*. Alabama river.
asperatus, *Lea*. Alabama and Coosa rivers; Cahawba river; Buck creek.
atro-costatus, *Lea*. Alabama and Coosa rivers; Cahawba river.
atro-marginatus, *Lea*. Chattahoochee river.

U. basalis, *Lea.* Carter's creek, (Ga.)
" bellulus, *Lea.* Tennessee drainage.
" biemarginatus, *Lea.* " "
" Bigbyensis, *Lea.* " "
" Binneyi, *Lea.* " Alabama." (Lea.)
" Blandianus, *Lea.* Coosa river.
" Boykinianus, *Lea.* Alabama, Chattahoochee and Coosa rivers; Buck creek.
" brevidens, *Lea.* Tennessee drainage.
" Brumbyanus, *Lea.* " Warrior river."
" cœlatus, *Conrad.* Tennessee drainage.
" Cahabensis, *Lea.* Cahawba river.
" camelopardilis, *Lea.* Tennessee drainage.
" camelus, *Lea.* " "
" camptodon, *Say.* Coffee creek and Big Prairie creek.
" caperatus, *Lea.* Tennessee drainage.
" capsæformis, *Lea.* " "
" castaneus, *Lea.* Alabama river.
" Chattanoogaensis, *Lea.* Coosa and Cahawba rivers; Bogue Chitto creek.
" Chunii, *Lea.* Near Selma.
" circulus, *Lea.* Tennessee drainage.
" circumactus, *Lea.* Tennessee drainage.
" Claibornensis, *Lea.* Alabama river.
" Clarkianus, *Lea.* Tennessee drainage.
" clavus, *Lamarck.* " "
" Clinchensis, *Lea.* " "
" compactus, *Lea.* Coosa and Cahawba rivers; Buck creek.
" concestator, *Lea.* Chattahoochee river.
" concolor, *Lea.* Big Prairie creek; Buck creek; Cahawba river.
" Conradianus, *Lea.* Tennessee drainage.
" consanguineus, *Lea.* Alabama, Coosa and Cahawba rivers.
" Cooperianus, *Lea.* Tennessee drainage.
" corneus, *Lea.* Chattahoochee tributaries.

U. cornutus, *Barnes.* Alabama, Coosa and Tennessee rivers.
" corvunculus, *Lea.* Cahawba river.
" Columbensis, *Lea.* Chattahoochee river.
" crassidens, *Lamarck.* Alabama, Coosa and Tennessee rivers. Cahawba river.
" crebrivittatus, *Lea.* Coosa river; Coosawattee river.
" crudus, *Lea.* Tennessee Drainage.
" cuneolus, *Lea.* Tennessee Drainage.
" cylindrellus, *Lea.* "Northern Alabama," (Lea).
" cylindricus, *Say.* Tennessee Drainage.
" decisus, *Lea.* "Alabama river," (Lea). Bogue Chitto creek.
" declivis, *Say.* Alabama. Shoal creek.
" decumbens, *Lea.* "Alabama," (Lea).
" denigratus, *Lea.* Chattahoochee river.
" deviatus, *Anthony.* Tennessee Drainage.
" discrepans, *Lea.* "Northern Alabama," (Lea).
" dispar, *Lea.* Chattahoochee river; Bogue Chitto creek.
" dolabelloides, *Lea.* Tennessee Drainage.
" dolosus, *Lea.* Alabama and Cahawba rivers.
" dromas, *Lea.* Tennessee Drainage.
" ebenus, *Lea.* Alabama river.
" Edgarianus, *Lea.* Tennessee drainage.
" Estabrookianus, *Lea.* Tennessee Drainage.
" excavatus, *Lea.* Alabama, Coosa, Black Warrior, and Cahawba rivers; Buck creek; Bogue Chitto creek.
" exiguus, *Lea.* Chattahoochee river; Shoal creek.
" extensus, *Lea.* Chattahoochee river.
" fabalis, *Lea.* Tennessee Drainage.
" fallax, *Lea.* Chattahoochee river.
" fibuloides, *Lea.* Coosa river (Showalter).
" flavescens, *Lea.* Black Warrior river.
" flavidus, *Lea.* Tennessee Drainage.
" Florentinus, *Lea.* Tenneessee Drainage.
" foliatus, *Hildreth.* Tennessee river.

U. Foremanianus, *Lea.* Coosa and Cahawba rivers; Buck creek.
" Forsheyi, *Lea.* Big Prairie creek.
" fraternus, *Lea.* Chattahoochee river; Cahawba river?
" fucatus, *Lea.* "Northern Alabama," (Lea). Tuscumbia.
" fumatus, *Lea.* Chattahoochee tributaries.
" Gerhardtii, *Lea.* Cahawba river; Buck creek. (Querie, Spillmanii?)
" germanus, *Lea.* Coosa river.
" Gesnerii, *Lea.* Uchee creek.
" gibbosus, *Barnes.* Tennessee river.
" glandaceus, *Lea.* Cahawba river; Buck creek.
" glans, *Lea.* Tennessee drainage.
" Gouldii, *Lea.* "Tuscaloosa," (Lea).
" gracilis, *Barnes.* Tennessee drainage.
" granulatus, *Lea.* Big Prairie creek; Coosa river.
" Greenii, *Conrad.* Black Warrior river.
" Hallenbeckii, *Lea.* Chattahoochee tributaries.
" Hanleyianus, *Lea.* Coosawattee river.
" Hartmanii, *Lea.* Coosa river.
" Haysianus, *Lea.* Tennessee drainage.
" Holstonensis, *Lea.* Tennessee drainage.
" incrassatus, *Lea.* Chattahoochee river.
" inflatus, *Lea.* Alabama river.
" infucatus, *Conrad.* Chattahoochee river.
" instructus, *Lea.* Cahawba river; Buck creek.
" intercedens, *Lea.* Chattahoochee river.
" intermedius, *Conrad.* Tennessee river.
" interventus, *Lea.* Cahawba river.
" irroratus, *Lea.* Tennessee drainage.
" Johannis, *Lea.* Coosa river (Showalter).
" Kleinianus, *Lea.* Chattahoochee river.
" late-costatus, *Lea.* "Tuscaloosa," (Lea).
" Lawii, *Lea.* Tennessee drainage.
" Lesueurianus, *Lea.* Tennessee drainage.
" lens, *Lea.* Tennessee drainage.
" Lewisii, *Lea.* Coosa river.

lienosus, *Conrad.* Creeks—Bogue Chitto creek.
limatulus, *Conrad.* Uchee Bar (Chattahoochee river). (Lea, X 43.)
ligamentinus, *Lamarck.* Tennessee river.
lineatus, *Lea.* Chattahoochee river.
linguæformis, *Lea.* Chattahoochee river.
litus, *Lea.* Cahawba river; Buck creek; Shoal creek.
luridus, *Lea.* Coosawattee river.
medius, *Lea.* Coosa river.
Meredithii, *Lea.* Spring creek, Tuscumbia. (Thornton.)
metanever, *Raf.* Alabama, Coosa and Tennessee rivers.
Mississippensis, *Con.* Coffee creek.
modicellus, *Lea.* Connesauga river and Chattanooga.
modicus, *Lea.* Chattahoochee river.
monodontus, *Say.* Tennessee river.
Mooresianus, *Lea.* Tennessee river.
multiradiatus, *Lea.* Tennessee river.
mundus, *Lea.* Tennessee river.
Nashvillensis, *Lea.* Beech creek; Shoal creek.
negatus, *Lea.* Big Prairie creek; Bogue Chitto creek.
neglectus, *Lea.* "Northern Alabama," (Lea).
nigellus, *Lea.* Chattahoochee river.
nucleopsis, *Conrad.* Coosa river (Showalter).
nux, *Lea.* Alabama river; Buck creek; Cahawba river; Shoal creek.
obesus, *Lea.* Chattahoochee river.
obtusus, *Lea.* Chattahoochee river.
obuncus, *Lea.* Tennessee drainage.
ornatus, *Lea.* "Alabama"? (Lea).
ovatus, *Say.* Tennessee river.
pallescens, *Lea.* "Tuscaloosa," (Lea.)
pallidofulvus, *Lea.* Cahawba river.
parvulus, *Lea.* Coosa river.
parvus, *Barnes.* Tennessee drainage.
paulus, *Lea.* Chattahoochee river; Beech creek.
pellucidus, *Lea.* Chattahoochee river.

U. penicillatus, *Lea*. Chattahoochee river.
" penitus, *Conrad*. Alabama river; Coosa river.
" perovatus, *Conrad*. "Green county," (Conrad).
" perovalis, *Conrad*. Alabama river.
" perpastus, *Lea*. Coosa river.
" perpictus, *Lea*. Tennessee drainage.
" perplexus, *Lea*. Tennessee drainage.
" perradiatus, *Lea*. Tennessee river.
" phaseolus, *Hildreth*. Tennessee river.
" placitus, *Lea*. "Alabama," (Lea).
" plancus, *Lea*. Coosa and Cahawba rivers.
" planicostatus, *Lea*. Tennessee drainage.
" planior, *Lea*. Tennessee drainage.
" plenus, *Lea*. Tennessee river; Alabama river.
" porphyrius, *Lea*. Coosa river.
" Postellii, *Lea*. Chattahoochee river.
" Prattii, *Lea*. Chattahoochee river.
" propinquus, *Lea*. Tennessee river.
" pudicus, *Lea*. "N. Alabama," (Lea).
" pullatus, *Lea*. Chattahoochee river.
" pulvinulus, *Lea*. Coosawattee river; Tuscaloosa.
U. purpuratus, *Lamarck*. Alabama river; Coosa river; Bogue Chitto creek.
" pustulosus, *Lea*. Tennessee river.
" Pybasii, *Lea*. Tennessee drainage; small streams; Coosa river; Shoal creek.
" pyramidatus, *Lea*. Tennessee and Alabama rivers; Coosa river (Showalter).
" pyriformis, *Lea*. Chattahoochee river.
" quadratus, *Lea*. Chattahoochee river or tributaries.
" radians, *Lea*. Cahawba river.
" radiosus, *Lea*. Tennessee river.
" Raeensis, *Lea*. Chattahoochee river.
" Rangianus, *Lea*. Tennessee river.
" recurvatus, *Lea*. " "
" Roswellensis, *Lea*. Chattahoochee river.
" rubellinus, *Lea*. Coosa river; Cahawba river; Shoal creek.

rubellus, *Con.* Black Warrior river.
rubidus, *Lea.* Coosa river and Big Prairie creek.
Rumphianus, *Lea.* Coosa and Cahawba rivers.
rutilans, *Lea.* Chattahoochee river; Shoal creek.
salebrosus, *Lea.* Chattahoochee or tributaries.
saxeus, *Conrad.* Alabama river.
scitulus, *Lea.* Spring creek, Tuscumbia.
securis, *Lea.* Tennessee river; Alabama river.
Showalterii, *Lea.* Coosa river.
simplex, *Lea.* Black Warrior river.
simulans, *Lea.* Cahawba river.
Sloatianus, *Lea.* Chattahoochee river.
Sowerbyanus, *Lea.* Tennessee river.
sparsus, *Lea.* " "
sparus, *Lea.* Shoal Creek.
sphæricus, *Lea.* Alabama river; Cahawba river.
stabilis, *Lea.* Coosa river.
stapes, *Lea.* Tennessee river.
Stewardsonii, *Lea.* " "
stramineus, *Conrad.* Uchee and other creeks; Beech creek.
striatus, *Lea.* Chattahoochee river.
strigosus, *Lea.* Chattahoochee or tributaries.
subangulatus, *Lea.* Chattahoochee river; Buck creek; Shoal creek.
subellipsis, *Lea.* Chattahoochee river; Buck creek; Shoal creek.
subgibbosus, *Lea.* Coosa river; Alabama river.
subglobatus, *Lea.* Tennessee river.
sublatus, *Lea.* Uchee bar; Buck Creek; Cahawba river; Shoal creek.
sudus, *Lea.* Chattahoochee river.
Taitianus, *Lea.* "Alabama river."
tenuissimus, *Lea.* Tennessee river.
tetralasmus, *Say.* Creeks.
Thorntonii, *Lea.* Tennessee river.
tortivus, *Lea.* Chattahoochee river.
trapezoides, *Lea.* Alabama river.

U. triangularis, *Barnes*. Tennessee river.
" trinacrus, *Lea*. Coosa river.
" Troschelianus, *Lea*. Coosawattee river.
" turgidulus, *Lea*. Florence.
" tuberculatus, *Barnes*. Big Prairie creek; Cahawba river.
" tumescens, *Lea*. Tennessee river.
" Tuscumbiensis, *Lea*. " "
" umbrans, *Lea*. Shoal creek.
" umdulatus, *Barnes*. Tennessee river.
" unicolor, *Lea*. Tuscaloosa.
" vallatus, *Lea*. Bogue Chitto creek; Buck creek; Cahawba river.
" verrucosus, *Barnes*. Tennessee river.
" verus, *Lea*. Cahawba river; Buck creek.
" verutus, *Lea*. Chattahoochee river.
" vibex, *Conrad*. Black Warrior river.
" virescens, *Lea*. Tennessee drainage; Spring creek, Tuscumbia; Beech creek.
" viridans, *Lea*. Chattahoochee river.
" viridiradiatus, *Lea*. Big Uchee creek.
" zig zag, *Lea*. Alabama river. [Querie, donaciformis Lea?]

Genus MARGARITANA, *Schum*.

M. Alabamensis, *Lea*. Talladega creek (Lea); Buck creek: Beech creek.
" complanata, *Barnes*. Big Prairie creek.
" Connesaugaensis, *Lea*. Head waters of Alabama river.
" Curreyana, *Lea*. Tennessee river.
" Elliottii, *Lea*. Chattahoochee river; Uchee creek.
" Georgiana, *Lea*. Tributaries of Coosa river; Shoal creek.*
" Gesnerii, *Lea*. Uphaupee creek.
" Holstonia, *Lea*. Coosa river (abounds in streams tributary to the Tennessee river); Shoal creek.
" marginata, *Say*. Tennessee river.

*[NOTE.—Possibly the shell referred to Shoal creek, as Marg. Georgiana may be Holstonia.

. minor, *Lea.* Tennessee drainage (small streams tributary to Tennessee river.)
rugosa, *Barnes.* Tennessee river.
Spillmanii, *Lea.* Cahawba river.
triangulata, *Lea.* Chattahoochee river.

nus ANODONTA, *Lamarck.*

. edentula, *Say.* Tennessee river.
Gesnerii, *Lea.* Uphaupee creek.
Hallenbeckii, *Lea.* Uphaupee creek.
Showalterii, *Lea.* Coosa river; Big Prairie creek.
subvexa, *Conrad.* Black Warrior river.

mily CORBICULADÆ.

Genus CYRENA, *Lamarck.*

Carolinensis, *Lamarck.* Mobile bay.

Genus SPHÆRIUM, *Scopoli.*

stramineum, *Conrad.*
fabale, *Prime.* Shoal creek.
occidentale, *Prime.* (Near Columbus, Ga.)
contractum, *Prime.* Grier's creek.

Genus PISIDIUM, *Pfeiffer.*

Virginicum, *Bourguignat.* Chattahoochee river.
abditum, *Haldeman.* Springs and small streams.

PECTINIBRANCHIATA.

Family MELANIDÆ.

Sub-Family STREPOMATIDÆ.

Genus STREPOMA, *Raf.*

Sub Genus Io, *Lea.*

o spinosa, *Lea.* Tennessee river.
o turrita, *Anthony.* Bridgeport. Tennessee river.

Sub Genus ANGITREMA, *Haldeman.*

.. angulata, *Wetherby.* Elk river. Compare *Wheatleyi* Tryon.

A. armigera, *Say*. Tennessee river.
" curta, *Lea*. Tennessee river.
" lima, *Con*. Elk river. (Compare verrucosa, *Raf*.)
" salebrosa, *Con*. Tennessee river.
" subglobosa, *Lea*. Tennessee river.
" Tuomeyi, *Lea*. Tennessee river.
" verrucosa, *Raf*. Tennessee river.
" Wheatleyi, *Tryon*. Elk river.

Sub-genus LITHASIA, *Haldeman*.

L. brevis, *Lea*. Alabama and Coosa rivers.
L. compacta, *Anthony*. Cahawba river; Buck creek.
L. cylindrica, *Lea*. Coosa river.
L. dilatata, *Lea*. Tennessee river.
L. Florentiana, *Lea*. Florence.
L. fusiformis, *Lea*. Coosa river.
L. imperialis, *Lea*. Tuscumbia.
L. purpurea, *Lea*. Cahawba river. (See Gon. purpurea, *Lea*.)
L. Showalterii, *Lea*. Cahawba river; Alabama river.
L. vittata, *Lea*. Coosa and Cahawba rivers.

Sub-genus STREBHOBASIS, Lea.

S. bitæniata, *Con*. "Black Warrior river."
S. carinata, *Lea*. "Tennessee river."
S. Clarkii, *Lea*. "Tennessee river."
S. cornea, *Lea*. Tennessee river.
S. corpulenta, *Anthony*. Tennessee river.
S. Lyonii, *Lea*. Tennessee river.
S. olivaria, *Lea*. Tennessee river.
S. plena, *Anthony*. Tennessee river.
S. solida, *Lea*. Tennessee river.

Sub-genus TRYPANOSTOMA, Lea.

T. abruptum, *Lea*. "Alabama," (Lea).
T. affine, *Lea*. Tennessee river.
T. Alabamense, *Lea*. Tennessee river.
T. alveare, *Conrad*. Tennessee river.
T. annuliferum, *Conrad*. "Black Warrior river."

Anthonyi, *Lea*. Black Warrior river, and Yellow Leaf creek.
aratum, *Lea*. "N. Alabama," (Lea).
attenuatum, *Lea*. Tennnessee river.
bicinctum, *Tryon*. Tennessee river.
bivittatum, *Lea*. Tennessee river.
Brumbyi, *Lea*. Coosa river, and at Huntsville.
canaliculatum, *Say*. Tennessee river.
canalitium, *Lea*. Yellow Leaf creek, and Coosa river.
castaneum, *Lea*. Coosa river.
Clarkii, *Lea*. "Florence; Coosa, Cahawba, and Alabama rivers." (See Appendix.)
Conradii, *Tryon*. Numerous small streams tributary to the Coosa, Cahawba, and Alabama rivers. (See pyrenellum, *Con*.)
curvatum, *Lea*. Tennessee river.
Currierianum, *Lea*. Yellow Leaf creek.
dux, *Lea*. Tennessee river.
excuratum, *Conrad*. Tennessee river.
filum, *Lea*. Tennessee river.
Florencense, *Lea*. Florence.
Foremanii, *Lea*. Coosa river.
gradatum, *Anth*. "Alabama."
gracile, *Lea*. Coosa and Cahawba rivers.
Hartmanii, *Lea*. Coosa and Cahawba rivers. (Compare *prasinatum*.)
hastatum, *Anth*. "Alabama."
incurvum, *Lea*. Tennessee river.
Jayi, *Lea*. Coosa and Cahawba rivers.
lativittatum, *Lea*. "Chickasaha river, Alabama," (Lea).
ligatum, *Lea*. Tennessee river.
Leaii, *Tryon*. Coosa river.
lugubre, *Lea*. "Alabama."
minor, *Lea*. Tennessee river.
modestum, *Lea*. Tennessee river. Tryon, page 101. Obs. IX.170. (See lugubre, *Lea*.)

T. moniliferum, *Lea.* Tennessee river.
T. moriforme, *Lea.* Chattanooga. Tennessee river.
T. nobile, *Lea.* Tennessee R., Jackson Co.
T. nodosum, *Lea.* Tennessee river. "Tuscumbia."
T. olivaceum, *Lea.* Tombigbee river.
T. planogyrum, *Anth.* "Alabama."
T. ponderosum, *Anth.* Tennessee river.
T. opacum. *Anth.* "Alabama."
T. Postellii, *Lea.* Tennessee river.
T. prasinatum, *Con.* "Alabama river;" also, in the Coosa and Cahawba rivers.
T. pumilum, *Lea.* Tennessee river.
T. Pybasii, *Lea.* Tennessee river.
T. pyrenellum, *Con.* Talladega Springs; Cahawba river; Buck creek; Clear creek; Coosa river; Sulphur Spring, six miles west of Jacksonville.
T. robustum, *Lea.* Tennesse river.
T. Showalterii, *Lea.* Cahawba river; Coosa river; Tuscaloosa.
T. spinalis, *Lea.* "Alabama."
T. striatum, *Lea.* Shelby Springs; Florence.
T. Thorntonii, Lea. Tennessee river.
T. tortum, *Lea.* Little Uchee river. (See lugubre, *Lea.*)
T. trivittatum, *Lea.* Tombigbee river.
T. Troostii, *Lea.* Tennessee river.
T. Tuomeyi, *Lea.* Tennessee river.
T. univittatum, *Lea.* Cahawba R. (See prasinatum?)
T. venustum, *Lea.* Big Prairie creek. (See vestitum, *Con.*)
T. vestitum, *Conrad.* Big Prairie creek; Green county; Four Mile creek; Buck creek.
T. Wheatleyi, *Lea.* Coosa river.

Sub-genus Goniobasis, Lea.

G. abscida, *Anth.* "Alabama." [Abnormal, old and eroded.]
G. acuta, *Lea.* N. Alabama. Tributaries of Tennessee river?
G. æqua, *Lea.* Yellow Leaf creek.

labamensis, *Lea.* Coosa river.
mbusta, *Anth.* Cahawba river. "Alabama."
mœna, *Lea.* "N. Alabama."
mpla, *Lea.* *Anth.* Cahawba and Coosa rivers.
ngulata, *Anth.* Cahawba river. [var. cinnamomea?].
rctata, *Lea.* Tuscaloosa.
uricoma, *Lea.* Tennessee river. (Querie instabilis?)
uriculæformis, *Lea.* "Tuscaloosa."
aculoides, *Lea.* Coosa river.
asalis, *Lea.* "Alabama." (Querie, young of *ampla*?)
ellula, *Lea.* Yellow Leaf creek; Cahawba river; Coosa river. (Querie, *Lewisii*, var?)
Bentoniensis, *Lea.* Benton Co.
Binneyana, *Lea.* Coosa river.
Boykiniana, *Lea.* Chattahoochee river.
Bridgesiana, *Lea.* Cahawba river.
Brumbyi, *Lea.* "Alabama."
brunnea, *Anth.* "Alabama."
ullula, *Lea.* Yellow Leaf creek.
Cahawbensis, *Lea.* Cahawba river; Montevallo.
alculoides, *Lea.* Coosa river.
apillaris, *Lea.* Coosa river.
arinifera, *Lamarck*, Montevallo; Clear creek; Blount spring; Gadsden; Jefferson county; Sulphur spring, 6 miles west of Jacksonville.
rino-costata, *Lea.* Montevallo; Talladega spring; Talladega; Buck creek; Calera; Shelby springs; Camp branch; Bowie's spring, 6 miles west of Talladega; Cahatchee.
sta, *Anth.* "Alabama."
tenoides, *Lea.* Chattahoochee river.
nnamomea, *Anth.* Cahawba river; Buck creek.
rcincta, *Lea.* Elk river; (querie, banded *plicatula*?)
ara, *Anth.* "Alabama."
arkii, *Lea.* Gravelly springs.
athrata, *Lea.* Jackson county; (very like *arachnoidea*, which is probably a synon. of *acuta*.)

G. clausa, *Lea*. Coosa river.

G. clavæformis, *Lea*. Talladega spring; properly belonging to tributaries of Tennessee river.

G. clavula, *Lea*. Jackson county.

G. cochliaris, *Lea*. Shelby county; [querie, *macella*?]

G. comma, *Con*. "Tributaries of Black Warrior river."

G. continens, *Lea*. Spring creek, Tuscumbia; Buxahatchee creek, near Shelby springs; [querie, Pybasii without bands?]

G. Coosaensis, *Lea*. Coosa river.

G. corneola, *Anth*. Coosa river; "Alabama;" [young of Lith. brevis?]

G. costulata, *Lea*. Jacksonville, Calhoun county; Sulphur spring.

G. crenatella, *Lea*. "Coosa river."

G. crispa, *Lea*. Florence.

G. cristata, *Anth*. Cahawba river; "Alabama;" *Anth*.

G. crebristriata, *Lea*. Tuscaloosa.

G. crepera, *Lea*. Yellow Leaf creek.

G. cruda, *Lea*. "Tennessee river."

G. culta, *Lea*. Cahatchee creek; Coosa river.

G. cylindracea, *Con*. Black Warrior river; "Tombigbee river."

G. DeCampii, *Lea*. Huntsville.

G. Dooleyensis, *Lea*. "Chattanooga;" (Lea's label.)

G. Elliottii, *Lea*. Little Uchee and Uchee river.

G. ellipsoides, *Lea*. Coosa river.

G. elliptica, *Lea*. Coosa river.

G. excavata, *Anthony*. Cahawba river; "Alabama;" *Anth*.

G. expansa, *Lea*. "Alabama;" Bowie's spring branch, 6 miles north of Talladega; (no figure extant); the apex of the young shell is plicate.

G. fabalis, *Lea*. "Tennessee river;" [querie, Coosa river?]

G. fallax, *Lea*. "Coosa river."

G. fascinans, *Lea*. "Yellow Leaf creek;" Cahawba river; Coosa river.

G. flava, *Lea*. "Benton co.;" Talladega county; Calera, Shelby county.

flavescens, *Lea*. Tennessee river; querie, erroneous locality?
formosa, *Conrad*. "N. Alabama."
fraterna, *Lea*. Bibb county and Cahawba river; [compare pulcherrima, *Anth.*]
fumea, *Lea*. Yellow Leaf creek.
furva, *Lea*. "Branch of Coosa river."
fuscocincta, *Anth*. "Alabama."
Gerhardtii, *Lea*. Montevallo; Coosa river; Turner's spring branch, 6 miles south of Talladega; Talladega.
germana, *Anth*. Cahawba river.
Gesnerii, *Lea*. Uchee river.
glabra, *Lea*. North Alabama; tributaries of Tennessee river.
glandaria, *Lea*. Coosa river.
Gouldiana, *Lea*. "North Alabama;" XII, 92.
grata, *Anth*. Big Prairie creek.
gravida, *Anth*. "Alabama."
grisea, *Anth*. "Tennessee river;" (doubtful.)
Hallenbeckii, *Lea*. Chattahoochee river.
harpa, *Lea*. "Tuscaloosa;" Coosa river; Cahawba river.
Haysiana, *Lea*. "Alabama;" Coosa river.
Hydei, *Conrad*. "Black Warrior River."
impressa, *Lea*. Coosa river.
inclinans, *Lea*. Tuscumbia.
inflata, *Haldeman*. Alabama river; (querie, *germana*?)
infuscata, *Lea*. Montevallo; "Coosa river."
inosculata, *Lea*. Little Uchee river.
intercedens, *Lea*. Montevallo; four mile creek; Bogue Chitto creek; Cahawba river; Little Mayberry creek.
interrupta, *Haldeman*. Buxahatchee creek.
interveniens, *Lea*. "North Alabama."
laeta, *Jay*. Coosa river; (querie, *læta*?)
lævigata, *Lea*. Alabama river; Talladega springs.

G. Lewisii, *Lea.* "Coosa and Tallapoosa rivers."
G. lita, *Lea.* Cahawba and Coosa rivers.
G. luteola, *Lea.* Coosa river; "Alabama river;" (querie, young *Lith. brevis*?)
G. macella, *Lea.* "Coosa river;" spring at Montevallo; (Coosa river doubtful.)
G. mellea, *Lea.* Coosa river; (querie, *ampla*, half grown?
G. nassula, *Con.* "Limestone spring at Tuscumbia."
G. negata, *Lea.* Coosa river.
G. obesa, *Anthony.* "Alabama."
G. oliva, *Lea.* "Alabama."
G. olivula, *Conrad.* "Alabama."
G. osculata, *Lea.* Coosa river.
G. ovalis, *Lea.* "Alabama;" Coosa river.
G. paula, *Lea.* Cahawba river; (see *fraterna*, Lea; subangulata, *Anth.*; *pulcherrima, Anth.*)
G. paupercula, *Lea.* "North Alabama."
G. pergrata, *Lea.* Coosa river.
G. perstriata, *Lea.* "Huntsville" and "Coosa river;" compare, *acuta*, Lea, and *carino-costata*, Lea.
G. porrecta, *Lea.* North Alabama; (essentially a Tennessee species found in creeks.)
G. procissa, *Anth.* "Alabama;" (Tryon doubts the local reference.)
G. propria, *Lea.* "Alabama;" (Coosa river?)
G. proxima, *Say.* Alabama; (see Tryon's Strepomatidæ.)
G. pudica, *Lea.* Alabama river; Coosa river; Yellow Leaf creek.
G. pulcherrima, *Anth.* Bibb county; [see paula, *Lea*; subangulata, *Anth*; fraterna, *Lea.*]
G. punicea, *Lea.* Alabama and Coosa rivers.
G. purpurea, *Lea.* Cahawba river; (Tryon says *rara?*)
G. pupæformis, *Lea.* Coosa river.
G. pupoidea, *Lea.* "Alabama;" Alabama, Coosa and Cahawba rivers.
G. Pybasii, *Lea.* Tuscumbia; Spring creek; (compare continens, *Lea.*)

. quadricincta, *Lea.* Coosa and Cahawba rivers; Talladega county; Montevallo.

. quadrivittata, *Lea.* Coosa and Cahawba rivers; Montevallo.

. rara, *Lea.* Coosa and Cahawba rivers.

. rhombica, *Anth.* "Alabama;" Cahawba river.

. rubicunda, *Lea.* Coosa river.

. semicostata, *Con.* Streams in North Alabama.

. semiquadrata, *Reeve.* "Alabama;" (*quadrivittata* or *gerhardtii.*)

. Shelbyensis, *Lea.* Yellow Leaf creek.

. Showalterii, *Lea.* Coosa river; Cahawba river.

. simplex, *Lea.* "Alabama;" (*Gon. virens, Anth.*)

. Smithsoniana, *Lea.* Montevallo; Gadsden; Cave creek; Talladega springs.

. solidula, *Lea.* Yellow Leaf creek.

. Spillmanii, *Lea.* "Tennessee river."

. straminea, *Lea.* "Coosa river;" (querie, young of *Lith. brevis?*)

. strenua, *Lea.* Benton county; Buck creek; Beech creek.

. subangulata, *Anth.* "Alabama;" Nix's marble quarry, Syllacoga, Talladega county; Bibb county.

. sulcata, *Lea.* Cahawba river.

. symmetrica, *Hald.* "Alabama;" Daley's creek; (Gon. imbricata, *Anth.*)

. Taitiana, *Lea.* Alabama river; Claiborn; Averitt's spring branch, s. e. part of Talladega county.

. tenebrovittata, *Lea.* Shelby county; "Coosa river."

. tenera, *Anth.* "Alabama."

. Thorntonii, *Lea.* Tuscumbia and Florence.

. trochiformis, *Conrad.* Streams in North Alabama; (querie, Try. filum, *Lea?*)

G. Tuomeyi, *Lea.* "No. Alabama."

G. Ucheensis, *Lea.* Little Uchee river.

G. Vanuxemiana, *Lea.* Alabama and Coosa rivers.

G. varians, *Lea.* Coosa river.

G. variata, *Lea.* Montevallo; Coosa and Cahawba rivers; Buck creek.

G. Vauxiana, *Lea.* "Coosa river."

G. venusta, *Lea.* Coosa river.

G. versa, *Lea.* "Yellow Leaf creek." Lily Shoals, Cahawba river.

G. vesicula, *Lea.* Black Warrior river. (Querie, young of Gon. cylindracea, *Con.?*)

G. vicina, *Anth.* "Alabama."

G. violacea, *Lewis* [MSS.] Rail Road Spring, six miles west of Jacksonville.

G. virens, *Lea.* "Alabama."

G. virgulata, *Lea.* Coosa river; Tallapoosa R. (Querie, young of G. ampla, *Anth.?*)

G. vittata, *Anth.* "Alabama."

G. Wheatleyi, *Lea.* Coosa river.

Sub-genus Eurycælon, *Lea.*

E. Anthonyi, *Redfield.* Tennessee river, Bridgeport.

E. crassa, *Haldeman.* Tennessee river.

E. gibberosa, *Lea.* Alabama river.

E. gratiosa, *Lea.* "Coosa river;" Alabama river.

E. lachryma, *Anth.*

E. lepida, *Lea.* "Yellow Leaf creek;" Alabama river, at Selma.

E. midas, *Lea.* Alabama and Coosa rivers. (Alabama river doubtful.)

E. nubila, *Lea.* Coosa river.

E. proteus, *Lea.* "Tuscaloosa."

Sub-genus Schizostoma, *Lea.*

S. Alabamense, *Lea.* "Alabama;" Coosa river.

S. amplum, *Anthony.* Coosa river.

S. Anthonyi, *Reeve.* "Alabama."

S. Babylonicum, *Lea.* "Tuscaloosa."

S. Buddii, Lea. "Tuscaloosa."

S. bulbosum, *Anthony.* Coosa river.

S. cariniferum, *Anthony.* Coosa river.

S. castaneum, *Lea.* Coosa river.

S. constrictum, *Lea.* "Tuscaloosa;" Coosa river.

S. curtum, *Mighels.*

S. cylindraceum, *Mighels*. "Warrior river."
S. demissum. *Anthony*. ——?
S. ellipticum, *Anth.* Coosa river.
S. excisum, *Lea*. "Alabama."
S. glandulum, *Lea*. Coosa river.
S. glans, *Lea*. Coosa river.
S. incisum, *Lea*. "Alabama."
S. laciniatum, *Lea*. "Tuscaloosa."
S. Lewisii, *Lea*. Coosa river.
S. nuculum, *Anth.* Coosa river.
S. ovoideum, *Shuttleworth*. ——?
S. pagoda, *Lea*. "Tuscaloosa;" Coosa river.
S. pumilum, *Lea*. "Alabama;" Coosa river.
S. pyramidatum, *Shuttleworth*. ——?
S. salebrosum, *Anth.* Coosa river.
S. Showalteriana, *Lea*. Coosa river.
S. sphæricum, *Anth.* Coosa river.
S. Wetumpkaense, *Lea*. Coosa river. [Querie, var. or young of pagoda?]
S. Wheatleyi, *Lea*. Coosa river.

Sub-genus ANCULOSA, *Say*.

A. ampla, *Anthony*. Cahawba river; Coosa river; Buck creek; Shoal creek.*
A. contorta, *Lea*. Coosa river. [Querie, Lith. compacta, *Anth.*]
A. Coosaensis, *Lea*. Coosa river.
A. Downiei, *Lea*. Coosa river. (Also found in Georgia.)
A. ligata, *Anth.* Tennessee river.
A. melanoides, *Con.* "N. Alabama."
A. picta, *Con.* Alabama, Coosa and Cahawba rivers,
A. plicata, *Con.* Black Warrior river.
A. prærosa, *Say*. Tennessee river. [Varieties are numerous.]
A. rubiginosa, *Lea*. "Warrior river;" Coosa river.
A. Showalterii, *Lea*. Coosa river.
A. squalida, *Lea*. "Tuscaloosa."

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*In creeks a small, black variety is found.

A. sub-globosa, *Say*. Tennessee river.

A. tæniata, *Con*. "Alabama river;" Coosa river.

A. tintinnabulum, *Lea*. Tennessee river.

A. virgata, *Lea*. Tennessee river. (—trilineata, *Say*, var.)

A. vittata, *Lea*. Cahawba river. [This has been elsewhere erroneously credited to the Coosa river.]

A. zebra, *Anth*. "Alabama." Coosa and Cahawba rivers.

Family VIVIPARIDÆ.

Genus VIVIPARA.

Sub-genus VIVIPARA.

V. contectoides, *W. G. Binney*. Tuscumbia.

Sub-genus TULOTOMA, *Haldeman*.

T. angulata, *Lea*. Coosa river.

T. bimonilifera, *Lea*. Alabama and Coosa rivers.

T. Coosaensis, *Lea*. Coosa river.

Sub-genus MELANTHO, *Bowditch*.

M. ponderosus, *Say*. Tennessee river. "All parts of the State." (*Aldrich*.)

M. ponderosus, *Say*. var. Nolani, *Tryon*. Coosa, Cahawba and Alabama rivers.

M. ponderosus, *Say*. (geniculate var.) Talladega creek.

M. ponderosus, *Say*. var. coarctatus, *Lea*. Coosa river.

M. ponderosus, *Say*. var. incrassatus, *Lea*. Coosa river.

M. decisus, *Say*. (geniculate var.) Talladega Creek.

M. decisus, *Say*. (coarctate var.) Big Prairie creek.

M. De Campi. *W. G. Binney*. Stevenson.

M. rufus, *Haldeman*. (geniculati var.) Talladega creek.

M. lima, *Anthony*. Huntsville.

Sub-genus LIOPLAX. *Troschel*.

L. subcarinata, *Say*. Chattahoochee river; Coosa river?

L. cyclostomatiformis, *Lea*. Coosa and Cahawba rivers; ack Warrior river.

Family RISSOIDÆ.

Genus Somatogyrus. *Gill.*

S. subglobosus, *Say*. Coosa river? Alabama river.
S. Currierianus, *Lea*. "Huntsville." Decatur.
S. parvulus, *Tryon*. Tennessee river at Bridgeport; osa river.
S. aureus. *Tryon*. Tennessee river; Cahawba river; abama river; Coosa river.

Genus Pomatiopsis. *Tryon.*

P. lapidaria, *Say*.

Family NERITIDÆ.

Genus Neritella. *Humphrey.*

N. reclivata, *Say*. Mobile Bay? (var. *Floridana*, uttleworth.
N. Showalterii, *Lea*. Coosa river.*

Family HELCINIDÆ.

Genus Helicina, *Lamarck.*

Sub-genus Oligyra, *Say.*

O. orbiculata, *Say*. Motevallo.

No specimens with opercles are known. It is therefore yet uncertain if s species be a *Neritella*.

PULMONATA LIMNOPHILA.

Family AURICULIDÆ.

Sub-Family AURICULINÆ.

Genus CARYCHIUM, *Muller.*

C. exiguum, *Say.* In moist, shaded stations.

Sub-Family MELAMPINÆ.

Genus MELAMPUS, *Montfort.*

M. bidentatus *Say.* Coast marshes.

Family LIMNÆIDÆ.

Sub-Family LIMNÆINÆ.

Genus LIMNÆA, *Lamarck.*

Sub-genus RADIX, *Montfort.*

R. columella, *Say.* Ponds and streams; near Selma.

Sub-genus LIMNOPHYSA, *Fitz.*

L. desidiosa, *Say.* Small streams and swamps.
L. caperata, *Say.* " " "
L. humilis, *Say.* " " " near Selma.

Genus PHYSA, *Draparnaud.*

P. gyrina, *Say.* Streams and springs.
P. elliptica, *Lea.* Streams and springs. P. oleacea, *Tryon.* Bridgeport.
P. crocata, *Lea.* Streams and springs.
P. Showalterii, *Lea.* Stream from Artesian well, Uniontown.
P. anatina, *Lea.* Streams.
P. Whitei, *Lea.* Streams in Georgia and Alabama.
P. pomilia, *Conrad.* "Randon's creek, near Claiborn."

Genus BULINUS, *Adanson.*

B. hypnorum, *Drap.* Swampy stations.

Genus PLANORBIS, *Guettard.*

P. glabratus, *Say.*

Sub-genus HELISOMA, *Swainson*.

H. bicarinata, *Say*. Ponds and streams. Beech creek; Cahawba river.
H. trivolvis, *Say*. Ponds and streams.

Sub-genus GYRAULUS, *Agassiz*.

G. dilatatus, *Gould*. (Has been found in N. W. Georgia.)
G. parvus, *Say*. Stagnant water and small streams.

Genus SEGMENTINA, *Fleming*.

Sub-genus PLANORBULA, *Haldeman*.

P. Wheatleyi, *Lea*. Swamp near Selma. (Aldrich.)

Sub-family ANCYLINÆ.

Genus ANCYLUS, *Geoffroy*.

A. diaphanus, *Hald*. Tennessee river.
A. ——— ? Coosa and Cahawba rivers.

Genus ACROLOXUS, *Beck*.

A. filosus, *Conrad*. Black Warrior river, south of Blount Springs; Coosa river?

PULMONATA GEOPHILA.

Family OLEACINIDÆ.

Genus GLANDINA, *Schum*.

G. truncata, *Gmelin*. Vicinity of the Gulf Coast.

Family HELICIDÆ.

Sub-family VITRININÆ.

Genus MACROCYCLIS, *Beck*.

M. concava, *Say*. Wooded districts.

Genus ZONITES, *Montfort*.

Sub-genus OMPHALINA, *Raf*. [Includes Hyalina, *Gray*.]

O. capnodes, *W. G. Binney*. Montevallo.
O. friabilis, *W. G. Binney*.

O. lævigata, *Pfeiffer*. Near Selma.
O. sculptilis, *Bland*.
O. Elliotti, *Redfield*.
O. arboreus, *Say*.
O. viridula, *Menke*.
O. indentata, *Say*. Near Selma ; Montevallo.
O. minuscula, *Binney*.
O. capsella, *Gould*.

Sub-genus MESOMPHIX, *Raf.*

M. demissa, *Binney*. Near Selma.
M. acerra, *Lewis*.
M. ligera, *Say*. Montevallo.
M. intertexta, *Binney*.

Sub-genus CONULUS, *Moq-Tand.*

C. fulvus, *Drap*. Near Selma ; Montevallo.

Sub-genus VENTRIDENS, *W. G. Binnney.*

V. gularis, *Say*.
V. suppressa, *Say*.
V. lasmodon, *Phillips*.
V. interna, *Say*. Montevallo.

Sub-family HELICINÆ.

Genus PATULA, *Hald.*

P. alternata, *Say*. Wooded districts; near Selma.
P. perspectiva, *Say*. Wooded districts near Selma.
P. striatella, *Anth*. Wooded districts.

Genus HELIX, *Lin.*

Sub-genus HELICODISCUS, *Morse.*

H. lineatus, *Say*. Wooded districts ; near Selma.

Sub-genus STROBILA, *Morse.*

S. labyrinthica, *Say*.

Sub-genus POLYGYRA, *Say.*

P. auriformis, *Bland*. Near Selma.
P. espiloca, *Ravenel*. Near Mobile.

plicata, *Say*. (Helix Hazardi, *Bland.*)
Febigeri, *Bland*. Near Mobile.
pustula, *Fer*.
pustuloides, *Bland*. Near Selma; Montevallo.
leporina, *Gould*.

Sub-genus STENOTREMA, *Raf*.

spinosa, *Lea*. Near Selma.
. labrosa, *Bland*.
. Edgariana, *Lea*.
. barbigera, *Redfield*.
S. stenotrema, *Fer*.
S. hirsuta, *Say*. Montevallo.
S. maxillata, *Gould*. Near Selma; Montevallo.
S. monodon, *Rackett*.

Sub-genus TRIODOPSIS, *Raf*.

T. palliata, *Say*.
T. obstricta, *Say*.
T. appressa, *Say*. Montevallo.
T. inflecta, *Say*. Near Selma; Montevallo.
T. Rugeli, *Shuttleworth*.
T. tridentata, *Say*.
T. fallax, *Say*.

Sub-genus MESODON, *Raf*.

M. major, *Binney*.
M. albolabris, *Say*.
M. elevata, *Say*.
M. Clarkii, *Lea*.
M. Christyi, *Bland*.
M. exoleta, *Binney*.
M. Wheatleyi, *Bland*.
M. thyroides, *Say*. Near Selma; Montevallo.
M. bucculenta, *Gould*. Near Selma; Montevallo.
M. clausa, *Say*. Near Selma.
M. jejuna, *Say*.
M. Mobiliana, *Lea*.

Sub-genus Vallonia, *Risso.*

V. pulchella, *Muller.*

Genus Bulimulus, *Leach.*

Sub-genus Scutalus, *Albers.*

S. dealbatus, *Say.* Northern Alabama; near Selma.

Genus Pupa, *Drap.*

Sub-genus Pupilla, *Leach.*

P. pentodon, *Say.*

Sub-genus Leucochila, *Alb. & Mart.*

L. fallax, *Say.*
L. modica, *Gould.*
L. armifera, *Say.* Common in cane brakes.
L. contracta, *Say.*
L. rupicola, *Say.*
L. corticaria, *Say.*

Genus Vertigo, *Muller.*

Sub-genus Isthmia, *Gray.*

I. Gouldii, *Binney.*
I. ovata, *Say.*
I. ventricosa, *Morse.*
I. milium, *Gould.*

Family SUCCININÆ.

Genus Succinea, *Drap.*

Sub-genus Succinea, *Drap.*

S. luteola, *Gould.*
S. avara, *Say.*
S. obliqua, *Say.*

PPENDIX TO THE UNIONIDÆ OF ALABAMA.

e student who may desire to become acquainted with Jnionidæ of Alabama, will naturally have his attention n to some interesting facts relating to Geographical ibution. In some instances a species will be found to in numerous localities, some of them beyond the lim- the State. In other instances, species bearing a very resemblance to each other occupy stations apart from other, seldom occurring together. Many species are, as is known, limited to a particular stream, or a portion ystem of drainage. Among the species having widest bution, may be mentioned *Unio Anodontoides*, which s in the Chattahoochee and Alabama rivers; and is 'ound in the Ohio river, and in some of the rivers in is. A group of species very strongly resembling each , embraces *Unio acutissimus*, *U. parvulus*, *U. rubellinus*, *J. penicillatus*. The two latter belong also to the State orgia. Another group of species strongly resembling other, varying somewhat in size and other minor de- embraces *Unio striatus*, *U. modicus*, *U. litus*, and *U. idus*, the last being found in North Carolina, and later rding to Mr. Lea), in Georgia.

l another group embraces species, a portion of which und in adjoining States, as well as in Alabama. Cu- y, it appears that some of these species sometimes estionably occur in the same station. This group em- s *Unio decisus*, *U. concolor*, *U. consanguineus*, *U. clavus*, *allidofulvus*, *U. interventus*, *U. crebrivittatus*, and *U. anoogaensis*. In the Chattahoochee river, *U. Sloatia-* ıkes the place of *U. trapezoides*, found in the Alabama

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river, and in the rivers of States westward; while on the other hand, *Unio Boykinianus* is found in the Chattahoochee and Alabama rivers, and probably, also, in some of the rivers of Mississippi. *Unio obtusus*, found in the Chattahoochee, also occurs in Mississippi, while a species of similar form, *U. Claibornensis*, takes its place in the Alabama river.

Unio infucatus and *U. Kleinianus* are said to occur in the Chattahoochee river and its tributaries in Georgia, while no available record exists of their having been found in the streams rising in Alabama.

Unio lienosus, found in Mississippi and various streams in Alabama, seems to be replaced in the Chattahoochee system by three well defined species of the same group, viz: *U. concestator*, *U. intercedens and U. fallax*.

Unio crassidens, a robust species found in Illinois, Ohio, Kentucky, Tennessee, and also in the Alabama and Coosa rivers, in Alabama, is replaced in the Chattahoochee and Flint rivers by a nearly related species—*U. incrassatus*.

Unio camptodon (and *Unio tetralasmus*, possibly a synonym,) occurs in Ohio, as well as in Alabama, Mississippi and Louisiana. *Unio Columbensis*, of the Chattahoochee, seems to unite *camptodon* with *declivis*, forming a group.

Unio atro-costatus, which is often taken to be *U. perplicatus*, Conrad, seems to take the place of that species in Alabama. There is no reliable record that *perplicatus* occurs so far east as Alabama.

Unio Blandianus, of the Othcalooga creek in Georgia, is represented in Alabama by shells which are regarded as being *U. Rumphianus*. If the two should prove to be identical, *Blandianus* will rank as a synonym of *Rumphianus*.

Unio penitus, of the Alabama river, is replaced further east (in Alabama and Georgia) by *U. compactus*, a similar but smaller species. It is possible that both these species occur in the Coosa river; but at the present time a doubt is entertained of such occurrence.

Unio castaneus, of the Alabama river, is the analogue of *U. circulus* of Tennessee and Ohio. Specimens are some-

seen in collections labeled *circulus*. *Unio unicolor* is
bly very similar to *castaneus*.

io *vallatus*, of Bogue Chitto creek, and *U. Cahabensis*,
e Cahawba river, very strongly resemble each other.

io *Edgarianus*, of the Tennessee river and its tributa-
s the type of a group of shells resembling each other
veral important particulars. *U. obuncus*, *U. Tuscumbi-*
and *U. Andersonensis* belong to this group.

nong the shells of the Alabama and Coosa rivers are
which remain to be noted as occurring in Tennessee,
&c.; *U. metanever*, *U. cornutus*, *U. pyramidatus*, *U.*
s, and possibly *U. plenus*, may be incuded in this list.
tuberculatus, which occurs in Alabama, is also found
io and adjoining States.

io *subangulatus*, of the Chattahoochee, is represented
ck creek by a larger shell of the same type, which
ot as yet been set apart as a distinct species. It may,
ver, be regarded as being quite as distinct from *sub-*
atus as *medius* is from *striatus* in the Chattahoochee
m.

the Cahawba river three species are indicated, under
ames *glandaceus*, *instructus* and *verus*. Specimens evi-
y referable to the three species have been submitted
xamination. They resemble each other very strongly
d, and differ simply as specimens of different ages and
might be supposed to differ, when a single species is
cted to a diversity of conditions.

e student will find that quite a considerable number
ecies originally quoted as found in various streams in
gia, have been catalogued as Alabama shells. Among
is *Unio radians*, originally found in the Othcalooga
in Georgia. Shells from Alabama agreeing very ex-
with the description and figure of this species have
submitted for examination. The shells that have
examined are, without doubt, the female forms of an
ama species called *U. plancus*. The question of the
ity of *radians* and *plancus* is still an opén one, in the
nce of Georgia specimens for comparison.

In the tributaries of the Chattahoochee river occur several species which belong to the "*complanatus group*"—a group which includes a large number of species, of which *Unio complanatus* is a familiar type. This group of shells prevails in the rivers of the Atlantic slope, and very few members of this group occur west of the Chattahoochee drainage. A single instance may possibly present itself in a species known as *Unio sublatus*, specimens of which have been found at or near Montevallo. It is possible, however, that *sublatus* really belongs to a group of which *U. gibbosus* is *almost* the sole type, (*Unio subgibbosus* being the exception.) The specimens referred to have the peculiar dark nacre and the singularly undulated breaks of *U. gibbosus*, though differing from that species in the form of the teeth, and in the details of the muscular and palleal cicatrices.

There remain abundant suggestions which might possibly be profitably added, but as this would necessarily involve much *descriptive matter*, it is deemed expedient to refer the student to the published writings of Isaac Lea, LL. D., in which will be found descriptions of a very large share of the Mollusca of North America, with usually very fine illustrations. The writings of Thomas Say, Mr. T. A. Conrad, Mr. John G. Anthony, Dr. Barnes, Hildreth, and others, might also be read with advantage.

Notes on CORBICULADÆ.

Cyrena Carolinensis is found on the Atlantic coast as far North as South Carolina. It occurs also on the west coast of Florida, and has been tabulated here on the presumption that it will unquestionably be found in Mobile Bay.

Shells referable to *Sphærium stramineum*, found in Alabama, are quite unlike any thing from other States that have been presented as that species.

A single specimen, only, of *S. fabale* is all that has been presented from Alabama.

Sphærium occidentale was found prior to 1860 in a swamp near Columbus, Ga.; whether in Alabama or Georgia is unknown. It will undoubtedly be found in similar situations in Alabama.

Pisidium Virginicum is found in numerous rivers in the
ited States, and undoubtedly will be found in muddy
tions of some of the rivers of Alabama.

APPENDIX TO STREPOMATIDÆ.

The Strepomatidæ of Alabama seem to be divided into three great groups. The first is characterized by the presence of the genera *Io* and *Angitrema*, which are locally restricted in this State to the Tennessee Drainage, in which they occur with a preponderating number of species of *Trypanostoma*, a smaller number of species of *Anculosa* and *Strephobasis*, and comparatively a few species of *Goniobasis*.

In the Alabama system of drainage comprising the Tombigbee, Black Warrior, Alabama, Cahawba, and Coosa rivers, and their tributaries, are found a less considerable number of species of *Trypanostoma*, a single species of *Strephobasis*, several species of *Anculosa*, and a preponderating number of species of *Goniobasis*. The characteristic genus of this system of drainage is *Schizostoma*, which includes a considerable number of recognized species. It is believed that this genus is confined to the Coosa river. Doubts, however, are suggested on that point by the fact that several of the earlier species brought to notice were credited to "Tuscaloosa," and the "Warrior river." No recent information on this point affords any means of settling the doubts, though it is hoped that explorations now under contemplation may bring to light conclusive testimony relative to the distribution of *Schizostoma*.

In the Chattahoochee river and its tributaries, have been found only a few species of *Goniobasis*, and possibly a single species of *Trypanostoma*.

In the original descriptions of some of the species of *Trypanostoma*, and *Gonoibasis*, found in the State of Alabama,

alities have been assigned that identify some of the spe-
s of the Tennessee system of drainage with certain forms
ind in the Alabama system. A careful examination of these
pposed cases of identity of species in the two systems
drainage has not as yet elicited any confirmatory evi-
nce. It seems, indeed, very probable, that not a single
tance of supposed identity will be verified. In expla-
tion, it may be remarked that collectors are *not* always
reful to keep apart from each other their unidentified
ecimens of species from various localities, and it is not
uncommon circumstance for specimens to pass into the
nds of the descriptive naturalist with local references of
unreliable character. This, together with the vague
d very indefinite mention of the *State* or *Continent* for
locality of a species, is surely the source of continual
uble to one who seeks to reconcile his shells with the
erature relating to them.

While the preliminary sheets of this paper were in pro-
ess, the writer was urgently solicited to embody in it
h facts in synonymy as might be thought useful. In
ly to these solicitations it may be urged that there is
t yet at hand, and may not be for many years to come,
ufficient amount of material to enable the most careful
dent to do justice to the subject, and not at the same
ne do injustice to those writers who have done most to
ine species.

A few of the difficulties of synonomy may be presented
a manner which will be appreciated by those persons
o have given the subject slight attention. Take, for in-
nce, some common and well known species of *Trypa-
toma*, found in the Tennessee river. On tracing it from
int to point along the stream it will be found to vary in
eral particulars, which are obvious at a glance. If only
extreme forms are known, these would appear to the
server to differ so much from each other as to justify
n in regarding them as distinct species—an opinion he
compelled to abandon when further investigation has
ought to light the intermediate forms. There may be,

and undoubtedly there are species, (as in the family Unionidæ,) in which the sexes are distinguishable from each other by certain peculiarities of form and size. This is a portion of the subject which has not yet been investigated, and really nothing is known relative to it. There are unquestionably instances in which *hybrids* occur. These, except under very favorable conditions for observation, would be likely to be regarded as *species*.

Occasionally abnormal specimens come to the notice of the Naturalist—usually a solitary specimen (and the author "regrets there were not more,") is all that is known, and it is recorded as a species. It sometimes happens that a species produces specimens the epidermis of which exhibits a uniform color without bands. Other specimens, on the other hand, have bands. Unquestionably, a species has been divided and put on record as *two distinct species*, with no better ground for the division than has been stated. Again, a species sometimes produces specimens characterized by several revolving elevated lines or carinæ. Mr. Say made a second species of *Goniobasis Virginica*, based on this peculiarity; Mr. Anthony has bestowed similar attention on a variety of Mr. Say's *Anculosa trilineata;* and a curious sequel to this is that many intelligent naturalists, who do not admit the validity of Mr. Say's "*Melania multilineata*," regard Mr. Anthony's *Anculosa costata* with favor.

There are yet other perplexities, and these arise out of the diversities of forms a species is liable to manifest when developed under the varying conditions of stations unlike each other in temperature, mineral properties of the water, abundance or absence of appropriate food, the influence of light, the influence of currents in the water, and finally, other influences of equal importance, which possibly have not yet been conjectured.

The *form* of a shell is simply a function of the mantle—a delicate membrane, in which the soft parts within the shell are included, and which lines the interior of the shell and deposits the calcareous matter of which it is composed.

color of a shell may, to a very great extent, depend that function of 'the mantle involved in the produc- of the epidermis. It may also be to some extent in- ced by the properties of the water in which the mol- lives.

will be seen that there are numerous conditions which affect a single species and cause it to be presented r such aspects as to create the impression that differ- ocal forms are different species. Much has been done e direction of synonymy, but without doubt, equally uch more remains to be done. It may also be sug- ed that a few errors have crept into synonymy, as it is received, and the work needs revision. In a class of s embracing so many species, presented under the dif- ies that beset the Strepomatidæ, it will be impossible more at present than suggest inquiries. The brief that occasionally appear in the list of species are all it seems expedient to suggest at this time.

APPENDIX TO VIVIPARIDÆ.

V. *contectoides* is distributed over a wide extent of territory. It inhabits the rivers of Illinois and Indiana. Specimens from Illinois have been successfully colonized in New York. Very fine specimens of the species are found in Othcalooga Creek, Georgia. A variety of this species occurring in Florida, has received the name V. Waltoni, *Tryon.*

Tulotoma bimonilifera, *Lea,* (magnifica, *Conrad,*) is admitted by the Academy of Natural Sciences to take precedence over *magnifica. T. Coosaensis,* hitherto regarded as a true *Vivipara,* is unquestionably a *Tulotoma,* and is well characterized as such by its opercle. Perfect specimens are characterized by numerous short, hairy prolongations of the epidermis on a considerable portion of the surface, and more particularly by a bristly fringe to the margin of the aperture.

Melantho ponderosus, *Say,* which occurs in the Ohio river, and some of its larger tributaries, and attains a large size in some portions of the Tennessee river, has also been found in Mississippi and Georgia, as well as in the rivers of Alabama. Mr. Tryon separates the Alabama shells under the name *M. Nolani.* A number of years ago, Mr. Lea described *Paludina coarctata* and *P. incrassata* from the Coosa river. From a careful comparison of numerous specimens of *Melantho* from the Coosa with shells from other regions and with Mr. Lea's unpublished figure of *coarctata,* it is inferred that *coarctata* and *incrassata* are identical with the shells Mr. Tryon calls *Nolani.* It may seem improbable that a species can exhibit so much variation in form in one locality; but it is apparently an unde-

niable fact, and has a parallel in the two species (?) described by Mr. Anthony as *Pal. subsolida* and *P. exilis*, both referable to the sexual varieties of one species. (In this connection it may be remarked that two specimens of this variable species served as illustrations of the male and female of *Melantho integer* in a work on the shells of North America.) Mr. Lea's *coarctata* is the slender form of the species. His *incrassata* is an immature specimen, the apex of which has been removed by erosion. If the *species* really be distinct from *ponderosus* it should receive the name *coarctata* or *incrassata*, either of which has priority of *Nolani*. A slender variety of *M. decisus* occurring in Big Prairie Creek has been confounded with the Coosa shell that Mr. Lea calls *coarctata*. There are peculiarities of form and color that should forbid the association of the Prairie Creek shell with the Coosa River *coarctata*.

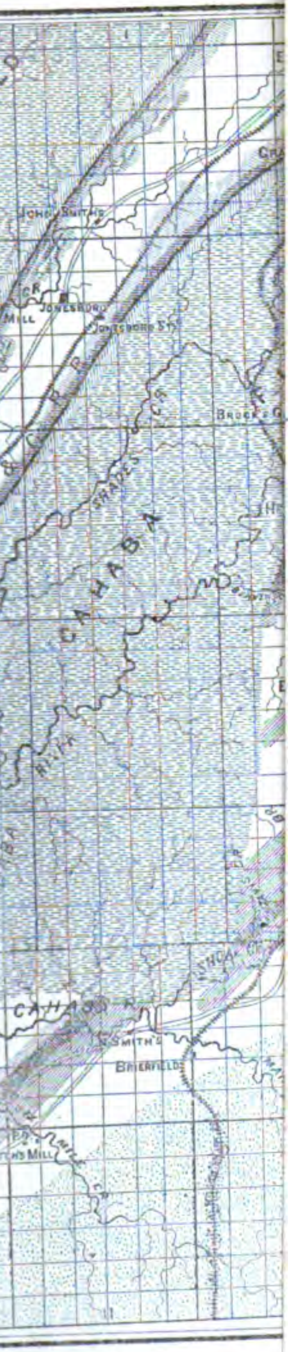
M. decisus, *M. ponderosus* and *M. rufus* occur together in Talladega Creek. They are all in a considerable degree characterized by the shouldered suture which distinguishes Mr. Conrad's *geniculus*.

M. lima, *Anthony*, occurs at Huntsville. It seems to be somewhat nearly related to M. De Campi. *W. G. Binney*. Possibly a full series of specimens might establish their identity.

Specimens doubtfully referable to *Lioplax subcarinata* have been presented as coming from the Coosa river. The specimens referred to have not the peculiar *salmon tinted* upper whorls that characterize *cyclostomatiformis* from the Coosa and Cahawba rivers, and differ in other respects also. It would be interesting to verify the occurrence of both these species in the Coosa river.

APPENDIX TO THE PULMONATA.

The fresh water pulmonates of Alabama seem not to have been thoroughly studied, and there are available no records that locate a considerable number of species which might very reasonably be expected to occur in the State. A large share of these have been omitted from the list—only such species being included as have a local record within the limits of the State or within contiguous portions of adjoining States. The land shells, having been more thoroughly studied, afford sufficient records to make it probable that only a few species likely to occur within the limits of the State have been omitted. It is quite probable that a careful exploration of the mountains in the northern part of the State may bring to light some of the few species that have recently been described as occurring in the not distant mountains of Tennessee and North Carolina. One of these—Mesodon Chilhoweensis, *Lewis*, occurs in northern Georgia, as is established by an immature specimen in the National Museum; and the occurrence of this species in East Tennessee and Georgia would seem to warrant the expectation that it might also be found in Alabama.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GEOLOGICAL SURVEY

— OF —

ALABAMA.

REPORT OF PROGRESS FOR 1877 AND 1878.

BY
EUGENE A SMITH, PH. D.,
STATE GEOLOGIST.

MONTGOMERY, ALA.:
BARRETT & BROWN, STATE PRINTERS.
1879.

His Excellency,

RUFUS W. COBB,

Governor of Alabama:

R—The Report of Progress of the Geological Survey, for years 1877 and 1878, is herewith respectfully submitted.

I have the honor to be, sir,

Your obedient servant,

EUGENE A. SMITH,

State Geologist.

NIVERSITY OF ALABAMA,

January 15, 1879.

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CHAPTER VI.—WARRIOR BASIN (Continued).

CHAPTER VII.—CHEMICAL REPORT.

PREFACE.

n previous Reports the Geological formations, older than Carboniferous, have been more particularly treated, and ccordance with the plan followed heretofore, of examin- and reporting upon the formations in the order of their logical age, the present volume will be devoted princi- y to the Carboniferous formation of the State.

he field work of the past season has been carried on in Sub-Carboniferous areas of North Alabama and of wn's Valley, and in the Coal-Measures of the Warrior in.

Vhilst the geological structure of the terranes of other nations, can often be made out from natural sections, and hout the aid of excavations, in the Coal-Measures the case uite different, for the reason that the most exact knowl- e is necessary of the thickness and relative position of various seams of a field, and the Coal, being the softest l most easily eroded of the rocks, is always found covered h soil and other débris which have to be removed before an be laid bare for inspection and measurement.

The sum appropriated by the State is barely sufficient to for ordinary expenses, leaving nothing for such work as uld be absolutely necessary for the thorough exploration a coal-field. I feel constrained to make this explanation, t I should be thought responsible for the meagreness of details concerning the coal seams, and the second-hand ture of many of the statements concerning their occur- ce and thickness.

The maps accompanying this report, have been engraved l printed in the most satisfactory manner by Mr. JULIUS EN, the topography having been taken mainly from the ge State map of Col. D. H. CRAM, who has kindly allowed s use to be made of it.

In the coloring I have departed from the usual custom of representing the Stratified Drift deposits, either by dotting the formations which they cover, or by leaving them out altogether as formation represented by a distinct color. My reason for this has been that in the Western parts of Fayette and Marion counties, the thickness of these beds is so great that the underlying formations have not yet in all cases been determined, and I have thought it best, where the Drift beds form the surface, and the underlying formations cannot be ascertained, to represent it so on the map.

The line of junction of Paleozoic and Cretaceous beds underneath this bed of sands and pebbles, will doubtless be traced out after some further examination, and the maps can then easily be changed.

Mr. HENRY MCCALLEY, of Huntsville, besides making for the Survey the analyses found in the body of this Report, has rendered very efficient aid in the field during the past season.

To Mr. T. H. ALDRICH, of Birmingham, I am particularly indebted for the information concerning the Coal-Measures of Jefferson County.

The ALABAMA GREAT SOUTHERN and the SOUTH AND NORTH ALABAMA RAIL ROADS have again placed the Survey under obligations for courtesies shown.

Finally, to the many citizens who have so kindly and in so many ways assisted in the prosecution of the work in the field, grateful acknowledgments are hereby made.

EUGENE A. SMITH.

REPORT.

CHAPTER I.

BASIN OF THE TENNESSEE IN NORTH ALABAMA.

y the term basin of the Tennessee, I mean to include in
: follows, not only the immediate valley of that river, but
the whole country drained by its tributaries.

ıder this definition, therefore, it will embrace an area on
sides of the Tennessee, from the State line on the north
e Coal Measures of the Warrior Field on the south.

ıat part of North Alabama in Jackson county, in which
iver flows down the prolongation of the great Sequatchee
y, from Bridgeport to Guntersville, whilst it might
erly be included in the hydrographic basin of the Ten-
ee, is much more naturally described in connection with
vn's valley.

hall therefore, in the sequel, in speaking of this basin,
ribe only that part of it lying west of the Sequatchee or
vn's valley fold, beginning where the Tennessee breaks
ıgh the rim of the valley below Guntersville.

e average width from north to south of this drainage
is about 45 miles.

e general features of the basin are those of a plain 12–15
s wide, the valley of the Tennessee, through which the
flows in its tortuous path; the valley bounded both on
ıorth and on the south, by hilly, and in some places al-
mountainous country; the hills like the valley belong-
o the same system, the configuration of the whole area
g the result of erosion during long geological periods,
aters whose *present* representatives are the Tennessee
its tributaries.

On the north the Highland Rim of Tennessee comes down into Alabama, forming the elevated country north of the Tennessee. This area is sub-divided, from an agricultural stand-point, into the "Barrens," and the *more fertile portions.*

The "Barrens" form a narrow belt in the extreme northern part of the State, characterized by a light colored siliceous soil which is not generally under cultivation. Within this division, however, are tracts with calcareous fertile soils.

South of the "Barrens," is the belt in which is included the valley proper of the Tennessee. The soil in this portion is calcareous, usually colored deep red, and is generally under cultivation. The face of the country is almost level, with the uniformity broken here and there by slight elevations, generally covered with trees and made up of fragments of chert. Upon these knolls are frequently situated the handsome dwellings of the planters.

Throughout this entire area *sink-holes* and *caves* are common and almost characteristic.

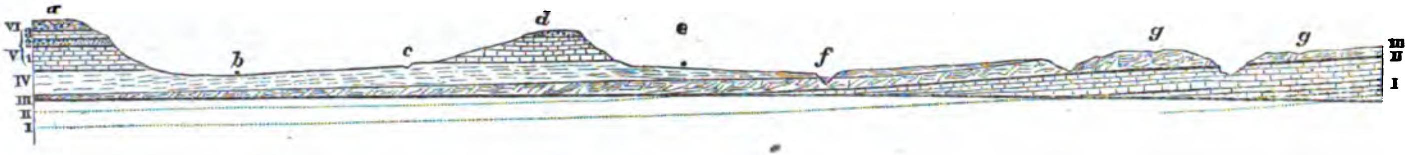
A second belt of the same character is found south of the main Tennessee valley, between what are known as the Little Mountains and the Main or Sand Mountain. Russell's and Moulton Valleys are here included.

Separating the Tennessee valley from the parallel valleys just mentioned, is a belt of mountainous country which increases in height and is more widely separated from the main mountain as we go westward.

Thus in Morgan county south of Whitesburg, the *Little Mountains* are wanting as a distinct range, whilst in Lawrence and Franklin counties they become a prominent feature, separated from the main ridge by wide and fertile valleys.

The description of the geological structure of North Alabama, will, it is hoped, be made clear by the subjoined figure, which represents a general section north and south from the Tennessee line to the Coal Measures of the Warrior Field, through Courtland and Moulton.

FIG. 1. GEOLOGICAL SECTION THROUGH NORTH ALABAMA.



EXPLANATIONS.

I. Silurian. II. Black Shale. III. Lower Siliceous. IV. Upper Siliceous. V. Mountain Limestone. VI. Coal Measures. *a.* Sand Mountain. *b.* Moulton. *c.* Big Nance Creek. *d.* Mountain Home. *e.* Courtland. *f.* Tennessee River. *g.* "Barrens." *Scale.*—Horizontal, 1 inch = 6 miles; vertical, 1 inch = 1000 feet.

Below is given, in tabulated form, the geological formations of this part of the State, with their equivalents in other States. The numbering is the same as that of the figure above.

FORMATIONS.	GROUPS.	EQUIVALENTS.
QUATERNARY	VII. Stratified Drift......	Orange Sand of Hilgard
CARBONIF. OR COAL MEAS.	VI. Coal Measures.....	Coal Measures.
UPPER SUB-CARBONIF...	V. 3, 2, 1 Mountain Limestone.	Chester Group.
LOWER SUB-CARBONIF...	IV. Upper Siliceous.....	St. Louis or Coral Limestone
	III. Lower Siliceous....	Keokuk and Burlington.
DEVONIAN.............	II. Black Shale.........	Genessee Shale.
SILURIAN.............	I. Niagara............	Niagara.
	(?). Hudson River	Hudson River.

The most important and widely distributed of these formations is the Sub-Carboniferous. It has been most closely studied in some of the Western States, particularly in Illinois, and, for this reason, the names given by the Western geologists, have been retained in the column of equivalents, wherever the identity of our rocks with those of the west has been recognized.

Lithological Characters and Distribution.

I. SILURIAN.—The rocks of this formation in North Alabama, are, beginning below, (1) a dark-colored earthy limestone, (2) gray magnesian limestone, and (3) bluish gray sandstone. The limestone (1) at the bottom of the series is supposed to belong to the Hudson River group of Lower Silurian; the other beds are members of the Niagara group of Upper Silurian.

These beds are exposed only in the bluffs of streams such as Elk River, Second Creek, Blue Water and Shoal Creek, which have their sources within the Tennessee line. The slight southern dip of the strata brings these lower formations nearer the surface in the extreme northern part of the State, so that they are within the reach of the denuding

waters of these streams. This is shown by the figure above given. Further south, the same strata pass under the overlying beds, and do not make their appearance again, until they emerge in the anticlinals of middle Alabama, on the other (southern) side of the Warrior Basin. The thickness of these beds in North Alabama is about 150 feet.

II. Black Shale.—This is in Alabama the only representative of the Devonian System which is so well developed in the more northern States. It is a black bituminous shale with nodules of iron pyrites, generally poor in fossils, though occasionally in Lauderdale county, according to Prof. Tuomey, where the lower layers of this formation are siliceous, they are characterized by an abundance of a small brachiopod shell of the genus *lingula*. The average thickness is 6–8 feet, though it rises to 15 feet in some localities.

This bed, like the underlying Silurian rocks, is exposed in the banks and bluffs of the little streams which flow into the Tennessee from the north. Mr. Thomas Hatch, formerly of Florence, states that he has discovered the Black Shale on the Tennessee river, four miles east of Florence; this, so far as yet known, is its most southern exposure in North Alabama. This formation, like the Niagara, passes under the limestones of the Tennessee valley, and the Coal Measures, and emerges again in the anticlinals already mentioned.

III. Lower Siliceous, Keokuk and Burlington Beds, "Barren" Group.—The rocks of this lowest division of the Sub-Carboniferous formation, are, next above the Black Shale. 1st, a gray crinoidal limestone, full of fragments of stems of encrinites, form which circumstance it gets its name *encrinital limestone*. The character of this rock varies with the locality, from a pure sparry, almost crystalline limestone, admirably adapted to architectural purposes, to an impure argillaceous shaly limestone, becoming sometimes almost a calcareous shale. In many places it takes the form of a siliceous limestone filled with crinoidal stems, and sometimes, according to Prof. Tuomey, it becomes an ordinary coarse sandstone. The thickness is variable, in some places, being 100 feet or more.

Above this, occurs a series of siliceous strata, having sometimes a thickness of 200 feet. These beds are regularly stratified, and may be defined in general terms as siliceous limestones. The character of the rocks varies from impure limestone, to hornstone or flint; the most common form being a coarse cherty rock.

The crinoidal limestone (lowest bed) is shown along the banks of streams north of the Tennessee, and also in many localities, in the bluffs of that river. It has been much used in the construction of the locks of the Muscle Shoals Canal.

The *siliceous beds* are well exposed in most of the bluffs, where the limestone occurs, and in addition, they form the surface rocks over considerable territory along the northern boundary of the State, forming the so-called "Barrens."—This term does not imply absolute sterility of soil, but it is used rather to mark the distinction between these and the more fertile areas, in which the St. Louis limestone makes the surface. As the rocks of this group vary from impure limestones to bedded cherts, so the soils derived from them show varying degrees of fertility. Within the Barrens are many tracts in a high state of cultivation, with fertile calcareous soils.

The frequent occurrence of hard flinty strata in this forma- is the cause of the rugged, broken surface of the country made by it. Where it is best exposed in the Tennessee river, it forms the Muscle Shoals, which have been so well described by Prof. Tuomey.

South of the Tennessee, these beds pass below the overlying strata, to make their appearance again beyond the Warrior Coal Field.

IV. Upper Siliceous, St. Louis or Coral Limestone.—This is, in many respects, the most important formation of North Alabama, for from it are derived the soils which have made the valley of the Tennessee one of the best farming areas in the State. The rocks as a whole, are cherty limestones, fossiliferous, and sometimes argillaceous. The chert of this division is generally easily recognized, being found in nodular masses which are "usually highly fossiliferous,

abounding in lace-like *bryogoa.*" A large coral, *Lithostrotion Canadense*, is one of the most characteristic fossils and from it the formation gets its name.

The country made by this formation is generally level, with low knobs formed of fragments of chert, remnants of the cherty portions of the limestone. These chert masses are nearly always highly fossiliferous, they are sometimes much decomposed, weathering occasionally to a white, chalky looking siliceous powder. The soil overlying the St. Louis limestone is usually colored deep red and orange by iron oxide which has come from the limestone and chert.

Over much of the St. Louis limestone area the iron oxide has accumulated in banks which are sometimes extensive enough to justify working. Instances of the occurrence of these ore-banks, together with analyses of the ores, will be found below in the proper places.

The limestones of this formation appear to have suffered subterranean erosion to a greater extent than those of any other except perhaps the Quebec or Knox Dolomite.

As a consequence sink-holes, caves, underground streams, and "big springs" become almost characteristic of the St. Louis group.

Some of the caves are inhabited by great numbers of bats, whose excrements cover the floors sometimes to the depth of several inches. This substance might perhaps be profitably used as a manure.

The following analysis by Mr. Henry McCalley will show its composition:

Analysis of Bat Guano from North Alabama.

Moisture	61.016
Combined Water and Volatile Organic Matter	26.473
Phosphoric Acid	2.270
Sulphuric Acid	217
Ammonia	668
Nitrogen, existing as Uric Acid, &c.	5.798
Lime	1.524
Magnesia	171
Potash and Soda	1.450
Insoluble Matter, Sand, &c	336
	99.923.

The St. Louis limestone occurs as the surface rock on both sides of the Tennessee river, forming the floor of the valley proper. This valley is bounded north by the hilly country formed by the Lower Siliceous rocks, and south by the Little Mountains, which are mere outliers of the main elevated plateau capped by the Coal Measures, and known as "the Mountain," or "Sand Mountain." Between the two mountain ranges, as will be seen by the figure, the St. Louis limestone is exposed again by denudation, and forms the surface in Moulton and Russell's valleys.

Both the upper and lower members of the Siliceous group pass under the Coal Measures, and reappear again in the anticlinal valleys further south; but there in diminished thickness, and not distinct from each other, the whole formation (siliceous) being cherty and fossiliferous. The thickness of the St. Louis limestone in North Alabama, will average perhaps 150 feet.

V. MOUNTAIN LIMESTONE, CHESTER GROUP.—This upper or calcareous member of the Sub-Carboniferous formation, is composed of limestones and shales with one bed of sandstone. The whole thickness of the group is between 650 and 700 feet in the eastern part of the valley near Huntsville, whilst it thins out westward to 100–150 feet in Lawrence and Franklin counties, with, exceptionally, a thickness of 350 feet.

The characters of the beds change also with the thickness, for near Huntsville they are mostly heavy bedded fossiliferous limestones with some shales, the sandstone bed being quite thin. In Lawrence, Colbert and Franklin counties, the limestones thin out and the sandstone bed becomes prominent, having often a thickness of 75 feet. In these western counties also, the sandstone bed is sometimes duplicated, the two parts being separated by limestone.

The Mountain limestone, as its name implies, outcrops (a) along the slopes of the spurs of the Cumberland Mountains in Madison county; and along the northern slopes of Sand Mountain in Morgan, Lawrence, and Franklin counties; also (b) on both slopes of the Little Mountains in Morgan, Lawrence and Colbert counties.

In the localities (a), it outcrops from beneath the sandnes and conglomerates of the Coal Measures, the interlded sandstone (2), of the formation, forming generally a ich or bluff at some distance below the crest of the mounns.

In the localities (b), the formation makes up the principal ss of the Little Mountains, the sandstone bed (2) itself ming the cap of the mountain.

In Colbert county where such streams as Spring, Little ar, Caney, and Buzzard Roost Creeks, have cut through Little Mountains, they flow through deep gorges or canons h perpendicular sides, the sandstone forming the top rock, h the limestones below; by this arrangement the sandnes are undermined by the weathering of the softer unlying rocks, and break off leaving perpendicular cliffs.—ese beds, like the others already described, pass under the al Measures, and emerge in the middle Alabama anticlis where the sandstone bed becomes a heavy formation, ilst the limestones are thinned down to 75 feet thickness. e limestones are usually fossiliferous, the upper bed just neath the Coal Measures being very generally a crinoidal nestone; lower down, the limestones are often argillaceous shaly, generally well filled with fossils, prominent amongst ich are *Pentremites* and *Archimedes*. Below the sandstone, e limestone beds are interstratified with shales; they are o fossiliferous and sometimes shaly.

The sandstone bed which, if a local name be desired, might called the La Grange Sandstone, is fine to coarse-grained, metimes heavy bedded, sometimes flaggy. Some localities, pecially La Grange in Colbert county, are well known from e great number and excellence of preservation of the fossil nts included in the sandstone. Trunks of Lepidodendron, gments of Sigillaria, and Calamites have been collected in mbers from this interesting stratum. In the middle Alama anticlinals as yet, no fossils have been observed in this ck.

In a few localities in Colbert county, where good sections ve been observed, the sandstone bed is duplicated, with

limestone between. In such instances the limestone passes into sandstone by becoming more and more siliceous, there being many places where it would be difficult to say whether the rock were limestone or sandstone. (See section at Mountain Mills in Colbert county, and near Pride's Station).

Between this sandstone and the strata of the Coal Measures, lie beds of limestone and shales, the uppermost bed being usually a crinodial limestone, full of fossils.

VI. COAL MEASURES.—The lower strata of the Coal Measures, as exposed in the escarpments of the Mountain in Madison, Morgan, Lawrence and Franklin counties, are about as follows: First above the crinoidal limestone, come thin-bedded sandstones, shales, and shaly sandstones, with two or three thin seams of coal. One of these coal seams in some localities, is thick enough to be worked, as for instance on Monte Sano near Huntsville. At this place the workable seam is about 40 feet above the topmost limestone bed of the Sub-Carboniferous formation; the thin seams being below the one worked. The thickness of these beds, including the coal seams, is variable; 75 feet might perhaps be taken as a fair average. Above these a bed of coarse grained sandstone, often a *conglomerate*, is usually observed. This rock forms generally a conspicuous bluff or bench along the sides of the mountains. In Madison and Morgan counties it has more the character of a conglomerate, whilst westward in Lawrence and Franklin counties it is generally a sandstone, and does not make so conspicuous a mark upon the mountain as it does in the first named localities.

In the anticlinal valleys south of the Warrior Field, (Murphrees', Jones', and Roup's), this rock is a prominent land mark, as it forms a well defined ridge along the edge of the valley. It is there underlaid by shales in which I believe no coal seams have yet been noticed. For further particulars concerning this bed and the Coal Measures overlying it, the reader is referred to the section treating of the Warrior Field.

VII. STRATIFIED DRIFT OR ORANGE SAND.—The beds of this formation appear in much greater thickness in the coun-

s south of the Tennessee Basin, and for this reason a de-
iption is omitted here. Full details will be found under
yette, Lamar and Marion counties.

MADISON COUNTY.

A line drawn diagonally through this county, from the northeast to the southwest, would divide it into two halves quite distinct in their geological features. East of this line, the county is broken, being formed of the spurs of the Cumberland Mountains, detached peaks, groups, and ridges, remnants of that great table land, continuous in Tennessee but separated here by valleys of erosion. In this eastern half the geological formations III, IV, V and VI, of the general section given on a preceding page, are represented.

Here, the low country (farming land) is usually made by the St. Louis Limestone, IV, the Lower Siliceous, III, being exposed only in the banks of streams, except perhaps in the extreme northern part of the county. The mountains which form so conspicuous a feature of this section have a *capping* of Coal Measures, VI, whilst the Mountain Limestone V, outcrops along the *slopes*.

West of this dividing line, the spurs of the Cumberlands are absent altogether, or occur only as isolated peaks. The geological formations are I, II, III, IV, of our general section.

The Lower Siliceous III, forms the surface in the Highlands or "Barrens" near the Tennessee line. In most of this area the underlying Black Shale, II, and Silurian, I, are exposed only in the banks of the streams flowing southward from the Tennessee line. The figure accompanying the general section above will show how a gentle dip of all the strata towards the south, brings these lower formations to the surface near the State line.

The St. Louis limestone, IV, is the surface formation of most of the valley south of the Highlands.

As the mountain spurs in the east of the county are con-

uations of the Tennessee Cumberland Mountains, so the ghlands here are parts of the Tennessee Highland rim. Fhe present report embodies the results of a reconnoissance a small portion only of the county, and I add below a few tions intended to present more in detail the geological ucture of the localities visited.

The following section of the strata exposed in Monte Sano ar Huntsville will show well the relations of the rocks in is part of the county. It was taken by Prof. A. H. Worthen, the Illinois Geological Survey. The thickness of the dif- ent strata are only estimated.

)AL MEASURES.	Ferruginous Sandstone..........	30 feet
	Slate and impure Coal...........	4 "
HESTER GROUP.	Light bluish gray limestone, containing teeth of *Aspidodus crenulatus*, N. & W., *Pentremites Godonii*, and *Archimedes*	40 "
	Shaly limestone, somewhat cherty, containing *Spirifer bisulcatus*, and *Terebratula ambigua*, mostly hidden under a covered slope..................	100 to 120 "
	Compact bluish gray limestone, semi-oolitic in part, containing *Penremites Godonii, P. pyriformis*, and *Archimedes*...............	250 "
	Ferruginous Sandstone with fossil plants....................	10 to 15 "
	Compact gray limestone, with *Pentremites*, and *Archimedes* in abundance, *Zeacrinus*, two or three species, *Agassizocrinus conicus*, *Productus elegans*, *P. semireticulatus*	200 "
	Decomposing cherty layers......	4 "
T.LOUIS GROUP.	Gray cherty limestones with some oolitic beds, containing *Lithostrotion Canadense*, *L. proliferum*, *Spirifer striatus* (?) and joints of crinoidea, with *Productus ovatus*, *P. semireticulatus*, &c.....	150 to 200 feet

KEOKUK (?).	Dark bluish gray, siliceous rock, weathering to shale in some localities, with a few fossil shells scarcely determinable.........100 "

On comparison of this section with others taken further west in Lawrence and Franklin counties, the predominance of the limestone strata, and the insignificance of the sandstone bed in the Chester Group, are particularly noticeable. In ascending Monte Sano, the limestones of the Chester Group are seen first, just beyond the Cemetery, and over the rocks of this group the road passes to within 40 or 50 feet of the summit, where the Coal Measures begin.

A cold spring breaks out from beneath a bed of limestone near the top, and a few feet above this limestone, in some of the first sandstone beds, a thin seam of coal, two or three inches thick, was observed.

The top of Monte Sano is a level plateau, upon which have been built several dwellings, summer residences of the citizens of Huntsville. On the eastern side of the mountain a chalybeate spring issues from beneath a sandstone ledge. This is near the junction of the sandstones of the Coal Measures and the limestones of the Chester Group, and I give the section as there exposed.

COAL MEASURES, VI.	Sandstones to summit........	75 feet
	Dark gray clay shales........	4 "
	Shaly sandstones...........	4 "
	White plastic clay...........	2 "
CHESTER ? GROUP, V.	Gray compact limestone.......	

The town of Huntsville is upon the St. Louis limestone, and the highly cultivated lands in the vicinity and westward towards Athens, as well as southwestward towards the Tennessee river, are formed by the same rocks.

The chert with which this limestone is filled, is often highly fossiliferous.

Near the Athens road are occasional areas of Lower Siliceous rocks, which, near the State line, become the prevailing surface rocks in the Highlands or "Barrens."

ORGAN AND MARSHALL COUNTIES.

In the present report, it is only the eastern part of Morgan d the western of Marshall, that will come under considera- n. South of Whitesburg on the Tennessee, the second ttom of the river in Morgan county, is two or three miles width. The slopes of Sand Mountain border this second ttom. The lowest rocks exposed on this slope are the nestones of the Chester Group V, of the general section ove. Above about 50 feet of these beds, there is a stratum soft, friable, sandstone 20 feet perhaps in thickness. In s immediate vicinity this rock does not make any decided uffs—but it forms the cap of a plateau some half a mile de, and elevated about 75 feet above the river. This sand- one is the bed V, 2, of the section, and at this place it does t form a ridge separated from the main mountain by a val- as is the case in Lawrence and Franklin counties, but it erely makes a bench along the slope of Sand Mountain.

Above this sandstone, are the beds V, 3, of our general ction, which are first thin bedded shaly sandstones, follow- by calcareous shales, then blue fossiliferous limestones, in bedded and shaly weathering into thin sheets; where e rock is much decomposed a great number of loose shells d other fossil remains, are formed in the clayey soil.

Above this, are compact blue limestones with occasional ale some 250 feet in thickness, followed by thin bedded ay limestone with layers of chert and shales, some 30 feet ick, up to the first ledge of sandstone of the Coal Measures, . The succession of these beds can perhaps better be en by reference to the following

Section of Sand Mountain South of Whitesburg.

COAL MEASURES, VI.		(7) Shales and Sandstones. (top of mountain), with two thin seams of COAL, separated by 60 feet of other strata....	150 feet
CHESTER GROUP, V.	3.	(6) Thin bedded gray limestones with shales, and cherty layers..	30 "
		(5) Compact blue limestone with occasional shales.............	250 "
		(4) Thin bedded blue limestone with interstratified shales, weathering into thin friable sheets, containing *Archimedes* and other fossils..............	30 "
		(3) Calcareous shales passing downward into thin flaggy sandstones 1–2 inches thick........	15 "
	2.	(2) *Ferruginous Sandstone,* soft and friable.................	20–25 "
	1.	(1) Limestone, compact, blue, fossiliferous....................	50 "
		Second Bottom of River........	

The limestones here between sandstones No. 2 and No. 7, are 325 feet in thickness. Between the same beds on Monte Sano, according to Prof. Worthen's section, there are 400 to 420 feet of limestone beds.

At this point the sandstone No. 2 is somewhat thicker and of more importance than on Monte Sano, though when compared with the same bed further west, as at La Grange, Pride's Station, &c., it is *here* comparatively insignificant. At this place there are 150 feet of Coal Measures on top of the mountain, and by barometric measurements the highest point of the mountain along this road, is near the northern edge, where it is about 550 feet elevated above the river at Whitesburg.

Southward the measures sink, as may be seen by the following barometric observations :

ghest point along the road near northern edge of Sand Mountain........................550 feet above river.
Ir. Hill's—6 miles S. of Whitesburg, (S. 23 T. 6 R. 1 W.)................500 " " "
Ir. Black's, near corner of S. 8, T. 7, R. 1, E........................250 " " "
)leander or Crop Roads, S. W. of S. 22, T. 7, R. 1, E..................225 " " "

t Mr. Black's the conglomerate is the surface rock, and a spring bursts up through it. Three miles west of this nt, coal is reported in a bed two feet thick. The Coal asures at this place (Mr. Black's), are only about 100 feet hickness, limestones of the Chester group being exposed avines, at about that distance below the level of the d.

At Oleander, a thin shaly seam of coal is struck in wells out 25 feet below the surface.

South and east of Oleander the Measures rise again to the which borders Brown's valley on the northwest side. ave no data for determining the height of this rim above river level, except eastward from Oleander towards Warton.

Southward from Oleander a bed of coal is known which is ne 100 to 150 feet above the level of that P. O.

Between Oleander and Warrenton the highest points crossby the road are about 425 feet above the river. Along s road at several points, but more particularly on Shoal eek at Ragsdale's Mill, the conglomerate is well exhibited. re the creek has cut through this rock, to a depth of 30-40 t, and into this gorge the water pours over two falls, nearequal in size and beauty to the falls of Clear Creek in inston county, where the rock is also a conglomerate, probly the same as this. Ragsdale's Mill is 250-275 feet above river by barometric observation.

Below this conglomerate on Shoal Creek, in S. 21, T. 7, R. E., and one and a quarter miles north of the mill, a bed of al 8-12 inches thick is exposed under a rock bluff.

The conglomerate here is a mass of quartz grains, holding small rounded pebbles of white quartz, about the size of peas.

This rock is well shown along the western rim of Brown's valley, two miles west of Warrenton; and the ridge continues on in a north-east direction to the river opposite Fort Deposit, at which place it is cut by the Tennessee; but the continuation of it is probably found on the other side running through Jackson county.

CHAPTER II.

BASIN OF THE TENNESSEE.—*Continued.*

.AUDERDALE AND LIMESTONE.

the present report, it is intended merely to give the lts of a reconnoisance of the lower parts of the two ties named, together with a few sections taken at varipoints, by Mr. Thos. P. Hatch, and which are furnished ugh the kindness of Dr. James M. Safford.

these counties, the following formations have been reized, the numbers corresponding to those of the general on above:

QUATERNARY.	VII. Stratified Drift, or Orange Sand.
JB-CARBONIFEROUS.	IV. St. Louis or Coral Limestone, Upper Siliceous. III. "Barren" group, Keokuk and Burlington, Lower Siliceous.
DEVONIAN.	II. Black Shale.
SILURIAN.	I. Niagara.

he strata of the Siliceous group(St. Louis limestone, and kuk) make up the greater part of the superficial area of counties: the lower formations, Black Shale and Niagara, g exposed only in the vicinity of the Tennessee line, re Elk River, Shoal, Cypress and other creeks have cut n through the overlying beds.

he strata have a slight southern dip as is shown by the ppearance of the lower formations towards the south, in ch direction they pass under the carboniferous rock, lst near the State line, they are exposed along the banks nost of the streams.

hat part of these counties in which the strata of the ver Siliceous group form the surface, has received the

name of "the Barrens," from the fact that the soils are not generally so productive as those formed from the overlying St. Louis Limestone. The soils are usually more or less sandy, and gray in color, though areas of fertile calcareous soils are not at all rare. The face of the country is also broken and hilly.

Where the upper Siliceous, or St. Louis Limestone forms the surface, the country is much more level, and more generally cultivated: occasional slight elevations formed by the débris of the more cherty portions of the limestone, and usually timbered, form an agreeable variation of the scenery, which is otherwise that of an unbroken plain almost entirely under cultivation. The soil is calcareous, generally colored deep red or orange by iron, and unusually fertile. Wherever the limestones of this formation prevail "sinkholes" are numerous.

The drainage of this entire area is southward into the Tennessee river.

DETAILS.

A general section of the strata of the upper part of Lauderdale county, made by Mr. Hatch, is as follows:

QUATERNARY VII.	1.	Conglomerate, Siliceous pebbles cemented by iron.	
SUB-CARBONIFEROUS (*Lower Siliceous.*) III.	2.	Ferruginous cherty strata, much decomposed......	25 feet.
	3.	Flinty strata............	60 "
	4.	Siliceous Shale.........	8 "
	5.	Gray crinoidal limestone	110 "
DEVONIAN. II.	6.	Black bituminous slate (Black shale)	8 ft.
SILURIAN. I.	7.	*a.* Bluish gray Sandstone. *b.* Gray limestone. *c.* Dark earthy limestone.	...150 ft.

This general section has been compiled from observations of exposures at various places in the county, particularly on Shoal Creek, Blue Water Creek, and on Elk River.

To the above may be added IV, Upper Siliceous, which is the surface formation of part of the county.

Mr. Hatch found some variation in the strata just overly-

the Black Shale. Thus, on the Tennessee River, four
es east of Florence, he found the Black Shale a little
ove the water's edge. At this point and on Second Creek,
out four miles from the State line, immediately above the
ck Shale, is a bed of dark shaly argillaceous limestone,
50 feet in thickness. In this, fossils are comparatively
e, and upon it rest the cherty strata.

t the mouth of Elk River and on Shoal Creek, the crin-
al limestone, full of fossils, overlies directly the Black
ale.

he same bed of crinoidal limestone overlies the Black
le also at Blair's Ferry on Elk River, on Sugar Creek, and
Blue Water Creek at the State line. (Hatch.)

Between Woodland and Florence, the country is made by
St. Louis limestone, and it is a beautiful, slightly rolling
ming land. Underneath this, beds of the lower Siliceous
eokuk, &c.) come in, and are exposed along the banks of
press Creek and other streams. Thus, on Cypress Creek
cherty beds No. 3 are seen at the crossing. Limestone,
h nodules of chert, forms the bed of the creek, and above
s, 18 inches of bedded chert, and over this limestones with
ings of irregular chert concretions which give to the bluff
med by the limestone, a very rough, knotty surface.

The deep gullies seen by the roadside near Florence,
pose angular masses of chert imbedded in a yellowish
m to the depth of 8 or 10 feet. This has no resemblance
the ordinary Stratified Drift, for the siliceous fragments
angular, showing that they are nearly in place, and have
t been transported like the rounded pebbles of the Drift.

A fine section of these flinty limestones, is shown in the
uff at the end of the bridge opposite Florence, where about
5 feet are exposed. The rock is a blue siliceous limestone,
ich weathers in places into a porous brown siliceous rock
th very rough surface. The lower layers of the section
posed here probably represent the dark shaly argillaceous
nestone described by Mr. Hatch as overlying, along the
nnessee River, the Black Shale.

Further up the river, just below the mouth of Blue Water

Creek, the cherty limestones are well exposed by the side of the canal. The bluffs are 25–30 feet in height; the limestone layers offer unequal resistance to weathering, and an overhanging ledge is left some ten feet thick, near the top. Where the rocks have been long exposed, strings of nodules, or irregular seams of chert between the beds of purer limestone, stand out in bold relief, furrowing the face of the bluff.

Near Lamb's Ferry on the southern bank of the river, about 50 feet of the argillaceous limestone are overlaid by the more cherty layers. They probably correspond to Nos. 5 and 3 of Mr. Hatch's section. Across the river, whilst no vertical exposures are seen near the road, a somewhat similar succession of rocks may be observed: the lower beds being hard shaly limestones, with siliceous limestones holding strings of nodules of chert above. Along with these rocks are numerous geodes lined inside with quartz crystals. The siliceous or cherty limestone shows many variations; at times it is a limestone with very little siliceous matter, which is in the shape of concretions, at times the siliceous matter seems to impregnate the entire mass, which upon weathering presents the appearance of a porous siliceous rock, sometimes almost a sandstone. Where rocks of this character form the surface, the soil is light colored, yellowish to white, not much cultivated.

Between Rodgersville and Blair's Ferry, bluish shaly limestones form the lowest beds seen in ravines and depressions; over these, are alternations of cherty limestones, with beds of chert and the porous siliceous rock mentioned above.

Between Blair's Ferry and Athens, the road is over the upper beds of the Lower Siliceous, the soil grayish or white, on the higher lands especially, which are timbered with white, post, red, and black-jack oaks, sweet-gum and sour gum, with a scanty undergrowth of chestnut and sour wood. The general elevation of this road above the Tennessee at Lamb's Ferry, is 200 to 225 feet.

[N]ear Athens the soil changes in character, becoming red- in color and more fertile, and as a consequence, cleared [fie]lds and large farms are more frequently seen. This change [is d]ue to the fact that the St. Louis limestone (Upper Silice-[ous]) forms the surface.

[B]etween Athens and Huntsville these red soils predomin-[ate]; but occasionally the lower Siliceous beds make the [cou]ntry and give the usual light colored soil of the "Bar-[ren]s."

[T]he St. Louis limestone is cherty in places, and the frag-[me]nts of this chert are usually the only rocks seen in the [b]ranes formed by this limestone.

[A]s a general thing the chert is full of fossils, crinoidal [ste]ms, brachiopods, and bryozoans. Many fragments will [sho]w inside an unchanged nucleus of chert, whilst the outer [par]ts are porous white, chalky, and friable. In the unde-[com]posed nucleus, the fossils are scarcely to be detected, but [wh]ere the decay has progressed they become very evident.

LAWRENCE COUNTY.

Topography.

Crossing this county from east to west near its southern part, is a mountain escarpment which forms the divide between the waters flowing into the Tennessee and those flowing into the Warrior.

Between Moulton and Courtland is another ridge (the "Little Mountain"), running like the first, east and west. This ridge is cut by all the streams flowing north into the Tennessee, and it separates the Moulton Valley on the south from the Tennessee valley on the north. The county is thus divided into four belts: two with prevailing sandy soils, formed by the two mountain ridges; and two with calcareous or limy soils occupied by the two great valleys mentioned.

Geological Formations.

1. *Distribution.*—In Lawrence county the surface is made up of two formations; the Sub-Carboniferous III, IV, and V, and the Coal-Measures VI. To these may be added, in a few localities, the Stratified Drift, VII.

The surface distribution of these formations is as follows: in the southern part, upon the Sand Mountain, is a belt of Coal-Measures six or eight miles wide; it includes all from the summit of the mountain southward to the Winston county line.

North of this belt to the Tennessee River the country is formed by the Sub-Carboniferous rocks.

Upon the summit of the mountain, especially in the southwestern part of the county, there are superficial beds of pebbles and sand belonging to the Stratified Drift, and these materials may probably also be found in isolated patches in

western part of Moulton valley near the Franklin county
.

. *Sub-Divisions.*—As in Franklin and Colbert counties, so
his, the subdivisions of the Sub-Carboniferous formation,
well represented. They are as follows:

UPPER, or CALCAREOUS.—Mountain Limestone. Chester Group.

. UPPER SILICEOUS.—St. Louis or Coral Limestone. St. Louis Group.

. LOWER SILICEOUS.—Barren Group. Keokuk, &c.

he greater part of the two valleys mentioned above, is
med by the St. Louis limestone, whilst the slopes of the
mountain ridges and the summit also of the Little Moun-
, are made by the strata of the Mountain Limestone.
he Coal-Measures, occupying as they do, only the sum-
of the mountain in the lower part of the county, are
ringly represented, and probably by the lower members
y of the series.

DETAILS.

n the road leading from Houston to Moulton, the summit
he Mountain at the gap, is about 250 feet elevated above
limestone of the valley, and about 300 feet above Moulton.
e summit, as has already been stated, is formed of the
dstones and shales of the Coal-Measures, whilst the
arpment overlooking the valley is made up chiefly of the
estones and other strata of the Mountain Limestone or
ester Group. Moulton valley has for its surface rocks
tly, the shaly limestones of the lower part of the Chester
oup, and partly, the upper beds of the St. Louis Lime-
ne or Upper Siliceous Group.
etween Moulton and Courtland a fair section of the
untain Limestone can be made. Four miles from Moul-
, at the crossing of Big Nance Creek, sandstones and
les are exposed in beds of varying thickness, and beyond
s point to Mountain Home, the road rises gradually over
strata of the Little Mountain—sandstone and shales

chiefly. At Mountain Home the elevation, by barometric observation, is 150 feet above Moulton, and the crest of the mountain overlooking the Tennessee valley, is some 50 feet higher still, or not more than 100 feet lower than the summit of Sand Mountain at the gap south of Moulton. The strata here, evidently fall away towards the south, for between the crossing of Big Nance Creek four miles north of Moulton, and the escarpment or summit of the Little Mountain, a distance of 6–8 miles, there is an ascent of 150 to 175 feet, principally over sandstones, whilst on going down the mountain towards Courtland, limestone is encountered 50 feet only below the summit, and at a distance of 125 feet below the same summit, limestone, with a great quantity of *Archimedes* and other fossils of the Chester Group.

By referring to the sections of Sub-Carboniferous strata in Franklin and Colbert counties, it will be seen that the Little Mountain owes its present height to the fact that a stratum of sandstone, one of the beds of the Chester Group, occupies its summit, and has protected it from denudation. This stratum, which is so marked a feature of the Chester Group in this and the adjoining counties, is the *Lower Sandstone* of Prof. Tuomey, and if a local name were needed, it might be called the *La Grange Sandstone* from its occurrence in that well known locality, where it holds the remarkable fossils spoken of below.

At Mountain Home this sandstone is 20 feet or more in thickness, and is underlaid by shales, the wearing away of which has, in places, undermined the sandstone, thus forming overhanging ledges or "rock houses." The beautiful spring at Mountain Home issues from beneath one of these ledges. The most beautiful, and often rarest, ferns of the State find a congenial soil and other conditions of a luxuriant growth, in these sheltered spots. *Asplenium pinnatifidum*, and *Aspl. montanum*, are most abundant.

As has been stated above, 125 feet below the sandstone summit of the Little Mountain, there is a fine locality for Chester fossils. The shaly limestone which holds these

ssils, forms a level, or nearly level, plateau, the surface of ıich is covered with the shells.

One hundred and seventy-five feet below the summit, are en fragments of chert, probably weathered out from the nestone of the St. Louis Group, and this limestone forms e surface thence out to the Tennessee river. The valley Courtland is, by barometric observation, 375–400 feet low the summit of Sand Mountain, south of Moulton.

What is said below concerning the Tennessee valley in olbert county, will apply also here. It is in general a level ain with a red soil of great fertility. The greater part of is plain is under cultivation, but slight elevations with nse growth of oaks, mark the localities of cherty porons of this limestone. The chert fragments which form ese slight elevations, are full of the lace-like impressions *bryozoa.*

Throughout the valley these elevations are not unfreıently occupied by the dwelling houses of the planters, overoking the fertile plains below.

Near the river the siliceous limestones of the underlying ower Siliceous Group III, form bluffs, occasionally 50 to 75 et in perpendicular height. Near Lamb's Ferry a bluff of is kind is made up of sparry crinoidal limestone with alterations of shaly and argillaceous limestone and strings of ıerty nodules.

At Green's bluff, opposite the mouth of Blue Water Creek, similar series of rocks is found.

On the opposite side of the river, in Lauderdale and Limeone counties, the exposures of these silico-calcareous rocks e better seen, and a more detailed description of them will e found under those counties.

Southwest of Courtland, the escarpments of the Little lountain extend in a broken range towards LaGrange. The ındstone caps the mountain everywhere, and forms bluffs f considerable height in many places. The outline of the ıountain against the valley is irregular, mountain spurs ith limestone coves between.

The old camp ground near Town Creek, is situated in one

of these coves, surrounded on three sides by the bluffs of LaGrange sandstone.

Between Courtland and the summit of Sand Mountain, south of Mount Hope, a section of the Sub-Carboniferous strata, up to the Coal Measures, is well exposed.

Along this road the shaly fossiliferous limestones of the Chester or Mountain Limestone Group, are encountered near the foot of the Little Mountain, at a height of 50 feet above the railroad. At 75 feet a nearly level plateau of considerable width is attained, rising towards the south. The soil upon this plateau is a stiff yellowish, and in places, whitish clay.

At an elevation above the railroad of about 110 feet occurs a bed of sandstone, and above this a ledge of limestone several feet in thickness. This, in turn, is overlaid by sandstone, which forms the mountain summit, at the point of crossing, something more than 175 feet higher than the railroad. The prevailing growth upon the mountain in this and the adjoining counties, is a mixture of Spanish, black, white, red, and post oaks, chesnuts, hickories, and short leaf pines. In some localities the pines prevail, and in others the oaks. Across the sandstone capping of the mountain, the distance is only four or five miles, then begins a descent into the Moulton or Mount Hope valley. The level of this valley is not much above that of the Tennessee valley, from which it is separated by the Little Mountain. The surface rocks here, as in the Tennessee valley, are chiefly the limestones of the St. Louis Group, but near the foot of the mountain, on each side, the Chester or Mountain limestone forms the surface.

Near the foot of the mountain, in the northeast corner of section 28, township 7, range 9, west, below Steenson's gap, strata of Mountain Limestone, with characteristic fossils, are encountered at an elevation of 150 feet above the railroad; below this are probably beds of considerable thickness of the shaly limestones of the same group, an exact measurement of which was not made. A section of the strata from

Mount Hope valley level, up to the summit at Steenson's ɔ, a distance of four miles, is nearly as follows:

ʟ-Measures VI.	(7.) Sandstones, alternating with shales and shaly sandstones, all showing considerable iron oxide—passing downwards into clay shales, with much iron oxide, partly in the form of sandy iron ore	100 feet.
	(6.) Coarse grained sandstones forming bluff, underlaid with shaly and fine grained sandstones—together	100 feet.
ɔuntain Limestone or Chester Group, v.	(5.) Limestone with fossils	25 feet.
	(4.) Siliceous sandstone, composed of rounded grains of quartz, dark colored from the oxide of iron	65 feet.
	(3.) Limestone with fossils	35 "
	(2.) Slope with clayey soil, strata not seen, probably argillaceous limestones (estimated)	100 feet.
. Louis, iv.	(1.) Cherty limestone at lowest level (estimated)	50 feet.
		475 feet.

In this section the relative thickness of the first two strata e estimated, and may differ considerably from the figures ven. The other measurements were made with the barometer, and are approximately correct.

No. 4, is probably the equivalent of the LaGrange sandone which forms the summit of the Little Mountain.

At the summit at Steenson's gap, the rocks of the Coaleasures are covered in places with beds of pebbles and nd belonging to the Stratified Drift. The crest of the ountain overlooking Mount Hope valley, has only a thin vering of these Drift Materials, but further south the e thickness increases.

Near the gap are reported occurrences of coal in many calities—these beds belonging, in all probability, near the ottom of the Coal Measures.

COLBERT COUNTY.

Topography.

East and west, through this county, runs a range of hills called the "Little Mountain," north of which lies the valley of the Tennessee, and south, Russell's Valley. Towards Russell's Valley the hills are covered with thick beds of pebbles, whilst towards the Tennessee valley the mountain sinks down rather abruptly, leaving an escarpment uncovered by pebbles.

All the streams of the county flow into the Tennessee, and all have their sources in the mountains north of Russell's Valley. In their courses towards the Tennessee, they have all, especially towards the west, cut gorges or small canons into the sandstone which forms the upper stratum of the Little Mountain. After leaving the mountain, they flow through the comparatively level valley towards the river.

In these mountain gorges are many scenes of wild and rugged beauty; and it is not strange that the chalybeate springs, which are so common there, have been so much frequented.

Geological Formations.

The geological relations of Colbert county are comparatively simple. The formations represented are two: (1) the Sub-Carboniferous, IV and V; and (2) the Stratified Drift, VII.

The Drift is found chiefly in the southern part of the county, on the borders of Franklin, and the beds of this age are of the usual type, viz: pebbles and sand. The pebbles are principally angular fragments of chert, often filled with casts and impressions of Sub-Carboniferous fossils. These beds have their greatest thickness near the Franklin line, thinning out towards the north upon the mountain.

he Sub-Carboniferous beds form by far the greater part he surface rocks of the county. The Valley of the Ten-see is formed by the siliceous limestones of the St. Louis up IV, whilst the more rugged and hilly portions of the nty are formed by the strata of the Mountain Limestone Chester Group, V.

few sections will make plain the relations of the Moun- Limestone and St. Louis group, in Colbert county.

he first section which I will give, is taken at the cotton ory near Barton's Station.

ion of Mountain Limestone, near the Mountain Mills, Colbert County.

UNTAIN	(5) Loose rocks and some pebbles forming surface, probably covering limestone	25 feet.
STONE	(4) Sandstone forming a cliff	55 "
OR	(3) Slope, strata not seen (probably limestone)	70 "
ESTER	(2) Sandstone and siliceous limestone forming cliffs	50 "
OUP, V.	(1) Fossiliferous limestone, not often seen, except in the gullies—makes a very heavy, sticky clay soil	150 "
		350 feet.

umber 2 is peculiar, consisting of alternations of sand- with highly fossiliferous limestone, containing *Archi-s*, &c. Some layers in this bed are highly siliceous stones or calcareous sandstones. These strata together a series of perpendicular cliffs, about 50 feet vertical ht.

umber 4 is a fine grained sandstone, forming the upper s of cliffs, which are at the point measured, about 50 in height. On top of this sandstone were beds of loose rial.

opes 3 and 1 are covered usually with fragments of the stone of the overlying beds; but they are made up of iferous calcareous rocks, as may be seen where exposures nade by washes or other cause.

These cliffs are shown all along the banks of Cane Creek, of Buzzard Roost Creek, and particularly along Rock Creek. They are caused by the erosion of the underlying softer beds, and the breaking off by vertical planes of large blocks of the sandstones thus undermined. Near the sources of some of these creeks, as at Newsom's Springs on Cane Creek, water, strongly impregnated with iron, issues from this upper sandstone. Chalybeate springs, having their origin in the same stratum, are well known and frequented in other parts of the county.

At Newsom's Springs the gorge of Cane Creek has perpendicular sides, some fifty feet or more in height, and at the bottom of this cliff, a rapid slope down to the water's edge.

Under the overhanging sandstone, is found the spring, and the sheltered spot under the cliff has been utilized as a hall for various amusements, ten pins, concerts, &c.

Near Prides' Station, on the M. & C. R. R., are cliffs of the same sandstones. A section of the strata exposed in these cliffs and the hills which they cap, is as follows:

Section of Mountain Limestone (Chester), and St. Louis Beds in the vicinity of Prides' Station, Colbert County.

MOUNTAIN LIMESTONE OR CHESTER GROUP, V.	(5) Siliceous sandstone, composed of clear glassy crystals of quartz cemented together—forming cliffs...	50 feet.
	(4) Limestone highly fossiliferous....	25 "
	(3) Sandstone and siliceous limestone, the limestone bands often quite pure and full of fossils; these beds form also a series of cliffs....	25 "
	(2) Shaly fossiliferous limestone (with Archimedes, &c.) yielding a stiff clayey soil which forms a gentle slope covered with fragments of fossiliferous limestone and of sandstone, from the overlying beds................	75 "

[S]t. Louis [Li]mestone, IV.	(1) Bedded Chert, or cherty limestone, to river level, generally full of casts of fossils (bryozoa being most abundant and characteristic). The upper of these beds form the general surface of the valley; it yields by disintegration a deep red colored soil, with here and there low knobs formed of the chert fragments.........	100 "
		275 feet.

This section is from the river level up to the top of the [highe]st hills south of the river, a distance of one and one quar[ter] miles. Whilst the cherty limestones, No. 1, are mostly [St.] Louis limestone, it is possible that the lowest beds may [be]long to an underlying group—Keokuk, perhaps.

The siliceous limestone, No. 5, is much like what has usu[all]y been called Millstone Grit in middle Alabama, and from [the s]ection at Boyle's Gap in Jefferson county, on the S. & N. [Al]a. R. R., given at another place, it seems quite probable [tha]t this sandstone is, in geological position, similar to the [lo]wermost of the siliceous sandstone beds which form the [mo]untain rim of the valley at that point. This subject will [be] more fully discussed in another place.

A third section, extending from the river near Florence, [th]rough Tuscumbia to La Grange, at the top of the moun[ta]in, shows the following:

MOUNTAIN LIMESTONE OR CHESTER GROUP, V.	(8) Reddish sandy shales, and thinly bedded reddish colored sandstones, forming summit of mountain at La Grange	35 feet.
	(7) Heavy-bedded siliceous sandstone, forming cliffs...........	30 "
	(6) Gray crinoidal limestone, full of fossils, the lowest two or three feet, of reddish color, with bryozoa, brachiopods, and other fossils	50 "
	(5) Slope, strata not seen, but presumably shaly limestone, surface covered with sandstone fragments	65 "
	(4) Bluish, and yellow shales.....	10 "
	(3) Shaly fossiliferous limestone, yielding a heavy clay soil......	25 "
UPPER SILICEOUS OR ST. LOUIS GROUP, IV.	(2) Cherty limestones, yielding deep red colored soil, and forming the general level of the valley, passing downwards into.	Together 150 ft.
LOWER SILICEOUS, III.	(1) Heavy-bedded silico-calcareous rock, weathering into porous brown siliceous rock, very rough on surface. These siliceous beds form the bluff on the river at the bridge opposite Florence.	
		365 ft.

The St. Louis Limestone, No. 2, forms here, as elsewhere in the valley, the general surface of the country. The land, underlaid by it, is usually nearly level, with slight undulations formed by the débris of the cherty portions of the limestone. These knobs are covered with a thick growth of oaks, and form an agreeable relief to the otherwise monotonous, open, cultivated plains.

The weathering of the St. Louis limestone gives rise frequently to under-ground water courses, which, in places, come to day, forming "big springs." A noted instance of this kind is the spring at Tuscumbia.

The heavy bedded siliceous sandstone, No. 7, is the same as No. 5 of the foregoing section. It forms here, as there, a

ies of cliffs. At La Grange, this stratum is famous for abundance and large size of the fossil remains of plants nd in it.

This locality was first brought to notice by Prof. Tuomey, his second Report. Some of the most remarkable of these sils were brought together as long ago as 1853, by Prof. W. Hardy, then President of La Grange College.

The finest specimen is a fragment of trunk of Lepidoden- n, showing distinctly the leaf impressions. This fragment bout three feet in diameter and four feet high. It is of dstone, and is otherwise remarkable from the fact that sandstone of which it is composed is full of impressions other plants, calamites, &c. These impressions can be n in the cross-section of the trunk, at the lower end, and y would appear to show that, in the process of petrefac- , the interior of the trunk was removed by decay or oth- e, leaving a hollow cylinder of the outer layers of the nk (bark, perhaps), and this hollow cylinder was filled up h sand and fragments of calamites and other coal plants. e subsequent induration of the sand, and the removal of shell of vegetable matter which formed the mould would e the fossil as we now find it. Another specimen showing leaf scars very imperfectly, if at all, is remarkable for the son that it is the lower part of a trunk, about the size of the ceding, but with two large roots attached. Other speci- ns of smaller size, but sometimes more distinctly marked, e also been collected. The specimens above described now in the Cabinet of the Survey at the University.

The larger specimens mentioned, were discovered on a hill out one mile from La Grange; but all the gullies which row the sides of the hill below the town on either side, constantly exposing fragments of these remarkable plants.

FRANKLIN COUNTY.

Topography.

The principal streams of this county are Town Creek, Spring Creek, Little Bear Creek, Cane Creek, and Big Bear Creek with its tributaries, Cedar Creek, Rock Creek, and Buzzard Roost Creek.

With the exception of Big Bear Creek, these streams all have their sources north of what is known as "The Mountain," which is an escarpment of the Coal-Measures overlooking the valley.

Big Bear Creek, on the other hand, takes its rise south of this escarpment, and flows at first southwest, as though a tributary of the Tombigbee, but its course is soon changed to westward, and then northwestward by an accumulation of pebbles and sands, and it then breaks through the mountain on its way northward to the Tennessee.

This pebble ridge is a noticeable feature of the topography of Franklin county. Overlying the Coal-Measures, it forms an irregular crescent, beginning in the southeast of Franklin, bending down into Marion, and returning again into Franklin county near its southwestern corner. The waters north of this dividing ridge flow into the Tennessee; south of it, into the Tombigbee.

The extraordinary deflection of Big Bear Creek, caused by this ridge, has just been mentioned, and it is an interesting fact that the waters of Big Bear Creek, on the north, are some 50 feet or more higher than those of the tributaries of the Tombigbee on the south, though the two are only a few miles apart.

Geological Formations.

In Franklin county, the formations represented are, (1.

ie Coal-Measures, VI; (2), The Lower or Sub-Carboniferous, ind IV; and, (3), The Stratified Drift, VII.

(1). *Coal-Measures.*—The northern limit of this formation an exceedingly irregular line, formed by ridges with lime-one coves between. East of Russellville, these mountain ongs extend northward as far as the middle of township 7, d a few project still further northward. West and south-st of Russellville, the line is less regular, and cannot well described without the aid of a map. The irregular line mountain-spurs, with interlocking coves, runs from Russell-le south and southwest to near the middle of township 8, ige 14 west, and thence southward into Marion county. cept near the southern line of the county, the strata of e Coal-Measures are found only near the summit of the ountain. For this reason their thickness is not great, and believe there is no point on the mountain where any coal d is worked in the county, but a bed of coal is reported in o localities near Waco: *e. g.* four miles south, and two and ie-half miles southeast of that place. Towards the west, e Coal-Measures and the underlying Sub-Carboniferous rmation are buried deep under great beds of pebbles and nd, so that it is only occasionally that the underlying rocks n be seen.

(2). *Sub-Carboniferous.*—The strata of this formation, und in Franklin county, belong to the subdivisions given low, in which the numbering corresponds with that of the neral section at the head of Chapter I.

The sub-divisions are:

JB-CARBONIFEROUS.	*Upper, or Calcareous,* (V). Mountain Limestone—Chester Group.
	Lower, or Siliceous, (IV). Upper, or St. Louis Limestone.

The strata of the Lower, or Keokuk Group (III), of the ower Siliceous, have not yet been observed in Franklin.

From a section taken a few miles south of Russellville,

the character of the Mountain Limestone in Franklin county may be tolerably well seen.

COAL-MEAS. VI.	(6) Sandstone and shales, to summit of mountain	75	feet
	(5) Sandstone, siliceous	50	"
MOUNTAIN LIMESTONE, V.	(4) Limestone with *Pentremites*, *Archimedes*, and *crinoidal* buttons	25	"
	(3) Sandstone	25	"
	(2) Limestone, shaly, with *Pentremites* and *Archimedes*	75	"
	(1) Argillaceous limestone, with large *cyathophylloid* corals (*Zaphrentis*)	40	"
		290	feet

This section is from Cedar Creek to top of the mountain, along the Tuscaloosa road. No. 1 may belong partly to the St. Louis group. The Sandstone, No. 3, is the Lower Sandstone of Prof. Tuomey.

(3). *Stratified Drift.*—In the western part of the county, thick beds of pebbles and sand cover all the underlying formations. These accumulations appear to have filled up the valley to the height of the rim of Coal-Measures. This rim, however, in the western part of the State is by no means so high as eastward, for instance near Huntsville. Through these beds of pebbles, &c., the tributaries of Big Bear Creek have cut their channels, down to the underlying limestones. A section of the rocks between Burleson and Nauvoo, for instance, shows that the streams have cut down into an encrinital limestone, to a distance of fifteen or twenty feet. Above this limestone are often found the remains of beds of chert of St. Louis age, and above this the Drift. Pebbles or angular fragments of this chert, sometimes cemented by hydrated ferric oxide into a conglomerate, make up a good part of these Drift beds, up to a height above the water courses, of one hundred feet. Above this height there are chiefly sands, with occasional masses of ferruginous sandstone, formed by the cementing together of the grains of sand by hydrated ferric oxide. The soil upon such high lands is light ash colored.

A close examination of the pebble beds of this and the vo counties south of it, shows pebbles of two sorts, viz: igular fragments of Sub-Carboniferous chert, and rounded ebbles of quartz. The former are found near the western mit of the Coal-Measures in Franklin, Marion, and Lamar unties, and, from their shapes, it would seem that they ave not traveled so far, nor suffered so much attrition as e quartz pebbles. In many cases, they seem to be fragents of underlying or neighboring Sub-Carboniferous (St. ouis) chert beds. On the other hand, the harder quartz ebbles are smoother, less angular, and they spread eastard over the eastern parts of Franklin, Marion, Fayette, id the western parts of Winston and Walker, being appantly much more abundant eastward, as, for instance, beveen Central Marion and Fayette out to the Byler ridge. ccasionally, west of the limit of the Coal-Measures, rounded ebbles of quartz may be found amongst the angular ones of iert; but they are not common. The larger rounded quartz ebbles are more frequently found near the water courses ian elsewhere.

Details.

In the southwestern part of Franklin county, the Drift overs the country south of Big Bear Creek. This Drift is omposed of angular chert pebbles in its lower parts, and bove, mostly of sands, sometimes cemented into ferruginous andstones, with occasional occurrences of tolerably good imonite. In crossing the water-shed between Bull Mounain and Big Bear Creeks, we descend (geologically) through he Drift into the underlying Sub-Carboniferous limestones Chester and St. Louis groups), which are exposed along the anks of Big Bear Creek. By aneroid observations, the waer level in this creek, at Burleson, is at least 75 or 100 feet above the waters of Bull Mountain Creek, near the postoffice of that name in Marion county. If these observations can be relied upon, there is considerable dip of the strata towards the south and west, for on Bull Mountain Creek strata of the Coal-Measures are exposed, whilst on Big Bear Creek

75–100 feet higher, the lowest strata seen are of Sub-Carboniferous age. There seems to be very little doubt that there is considerable difference of level between the two creeks mentioned, as the aneroid observations are confirmed by levelings made by railroad surveys.

In coming northward from Bull Mountain Creek P. O., the way is along ridges, averaging 150–200 feet in height above the water courses. Below the height of 200 feet, pebbles or angular fragments of chert are abundant, forming occasionally thick beds. Above that height none are found, the surface being usually sandy, with ferruginous sand rocks covering the tops and sides of hills. South of Burleson, on Big Bear Creek, the ridges are at least 250 feet above the waters of Bull Mountain Creek, and the surface soil a reddish sandy loam.

From Burleson downwards, Big Bear Creek cuts through strata of the Sub-Carboniferous formation chiefly. Above Burleson (up the creek), for several miles, appear the Sub-Carboniferous limestones, and beyond that, the sandstones, &c., of the Coal-Measures. Between Big and Little Bear creeks, is a high ridge elevated 225 feet or more above the former stream. The first 100 feet of this height seem to be made up mostly of the limestone and chert of Sub-Carboniferous age, and over that beds of Drift materials, angular chert pebbles below, sands and sandy loams above.

Little Bear Creek leaves the Coal-Measures a mile or two below the crossing of the Military road, and flows the rest of its course through Sub-Carboniferous and Drift beds.

The escarpment of Coal-Measures Sandstones, which forms so marked a feature in the southern part of the Valley of the Tennessee, as far west as Russellville, loses its importance west and southwest of that town, partly because of the diminished height of the escarpment itself, and partly because of the fact that beds of Drift have filled up the valley to the level of the top of this escarpment. Thus, for instance, if we start from Burleson, and travel eastward along the dividing ridge between Big and Little Bear creeks, we come upon the plateau of the Coal measures, without ascend-

any sudden elevation. The dividing ridge spoken of is le up chiefly of Drift beds, which are thus nearly at the el of the Coal-Measures, or slope gently up to them, ing completely any escarpment that may have existed.

etween Nauvoo, southeast corner of section 17, township ange 13 west, and Russellville, the road is principally r limestone and chert, probably of the St. Louis group. presence of large quantities of hydrated ferric oxide in decayed masses of cherty limestone, is very noticeable, in several localities it is found of sufficient purity to be ood ore of iron. This is particularly the case near the ssing of Cedar Creek southwest of Russellville, where nerly a Catalan forge was situated.

lear the crossing of Cedar Creek, a few miles west of ssellville, begins Russell's Valley, which stretches east-rd, near the foot of the mountain past Russellville and wburgh, into Lawrence county, where it takes the name Moulton Valley.

'he average width of the valley is perhaps five or six miles, l it is limited on the south by the mountain of Coal-asures already spoken of, and on the north by thick de-its of gravel and sand, which cover the strata of the untain Limestone. The valley is a furrow cut down ough the Mountain Limestone into the limestone of the Louis group, or Upper Siliceous.

long this valley, pebble beds are not very common, whilst t north of it, they are, in places, one hundred feet in thick-s.

imonite is found in local accumulations, as ore banks m Cedar Creek to Newburgh, and the soil for this whole tance is colored deep red. A mile from Russellville, on Courtland road, limonite ore banks, on Dr. Sevier's land, re examined.

Two samples of ore, from this locality, were analyzed by . Henry McCalley, in the Laboratory of the Survey, with results given below:

Analysis of oolitic limonite; color, dark brown; streak, brownish-red; locality, one mile east of Russellville, in Franklin county.

Specific gravity	3.616
Moisture (hygroscopic)	1.648
Combined water	10.444
Siliceous matter	3.159
Sesquioxide of iron	84.696
Alumina	.220
Oxide of manganese	.087
Lime	.440
Magnesia	.025
Phosphoric acid	.765
Sulphur	.054
	101.539
Metallic iron	59.287
Phosphorus	.334

Limonite, with smooth glazed surface, with outer shell of fibrous texture; exterior surface black; on fractured surface, liver brown; brittle and very hard; streak, dark brown; locality, one mile east of Russellville, Franklin county.

Specific gravity	3.800
Hygroscopic moisture	.833
Combined water	11.849
Siliceous matter	2.864
Sesquioxide of iron	83.514
Alumina	1.411
Oxide of manganese	.168
Lime	.407
Magnesia	.045
Phosphoric acid	.760
Sulphur	.085
	180.206
Metallic iron	58.459
Phosphorus	.332

Going south from Russellville, on the Tuscaloosa road, a hill of 175 feet elevation, is reached about one mile from the town. This hill is composed of the débris of chert beds, with much limonite, the soil a red colored sandy loam. South of this hill, the spurs of the Coal-Measures come down

thin two miles of Russellville. Between these mountain
urs are limestone coves, often of several square miles area.
e Tuscaloosa road reaches the foot of the mountain at the
o of one of these coves, seven miles from Russellville. The
ction along this road, from Cedar Creek to top of the
ountain, has already been given above.

Between Russellville and Frankfort, the road lies over
lges of angular chert pebbles. The water courses crossed
e, in general, somewhat over 200 feet below the level of
ese pebbly ridges.

CHAPTER III.

Brown's Valley.

This includes parts of Jackson, Marshall, Cullman, and Blount Counties.

STRUCTURE OF THE VALLEY.

It is known to Geologists that after the deposition of the strata of the Carboniferous Formation, there followed a period of mountain making in the eastern part of North America. Amongst the most important results of the forces which came so prominently into play during this time, were the elevation of a wide belt running northeast and southwest, approximately parallel to the Atlantic coast, and the crushing together and wrinkling up of the strata of this belt, into folds having the same general northeast and southwest trend. The great folds or flexures thus impressed upon the face of the country, were of several kinds: some were simple folds; others were broken or fractured along the crest line; still others were fractured along this line, and the strata on one side of the line of fracture, were dropped down below the corresponding beds on the other side, thus producing what are known as *faults*. This elevated belt, with its folded and faulted strata, is a mountain chain known as the *Appalachian*, which extends from Pennsylvania into Alabama, where it terminates.

The clain is a complex one, made up of several distinct ranges: the Blue Ridge, the Alleghanies, and the Cumberland Mountains, naming them in order from east to west. The more prominent characteristics of the three mountain ranges above enumerated, may be given in a few words. The strata of the Blue Ridge have been folded and crushed together in the most complex way—and in addition, the rocks

ve been changed into crystalline slates or schists, which
much harder and more resistant to denudation than the
changed beds, so that in the Blue Ridge region we find
gged mountainous and broken country. I may say also
at portions of the Blue Ridge were partially elevated be-
e the period above mentioned at the close of the Carbon-
rous formation. The Blue Ridge is, in general, the water-
ed between the Atlantic and the Mississippi basin.

In the Alleghanies we find the rocks much less changed
m their original condition, except along the western edge,
ugh they are rarely found in horizontal beds; having
n much folded, so that the strata all dip considerably.
e upturned and outcropping edges of beds of different
grees of hardness impress themselves upon the scenery of
s region, forming rocky ridges with beautiful valleys be-
een.

The strata of the Cumberland region, or table land, are
ally horizontal or very slightly inclined. This uniformity
nterrupted in a few instances by long narrow folds, run-
g parallel with the folds of the other two regions, and with
general direction of the Appalachian chain.

t is to one of these long folds in the Cumberland table-
d to which we now direct the attention in speaking of
wn's Valley.

Beginning with the Crab Orchard Mountain in Morgan
nty, Tennessee, we may trace a fold of the rocks in a con-
ous line for a distance of 225 miles, nearly due south-
t through Tennessee into Alabama, to its termination
r the junction of the Big and Little Warriors, between
lker and Jefferson Counties.

The middle portion of this great fold, from the head of the
uatchee valley in Tennessee to Reid's Gap in Alabama,
been broken or rent open along its summit, and along
rent or crack, water has excavated a valley 160 miles long
5 or 6 miles wide, (Safford), called in Tennessee, Sequat-
e Valley; in Alabama, Brown's Valley. The two ends of
fold have the strata *unbroken* along the crest line, thus
ning ridges. The Tennessee end of this unbroken part of

the fold is called the Crab Orchard Mountain, the Alabama end has no distinctive name, but it is the ridge separating the waters of the two Warriors, and extending from Reid's Gap southwestward to near the point of confluence of the two rivers—a distance of twenty-five or thirty miles.

The Cumberland table-land has for its surface rocks the strata of the Coal Measures. Beneath these are the limestones, &c., of the Sub-Carboniferous, and other underlying formations.

All these strata are involved in the fold, and in that part where the valley has been excavated, the denuding waters have cut down into the limestones of the Sub-Carboniferous and in some places still deeper, into the lower Silurian formation.

Prof. Safford, in this connection says, "This fold, including its geographical and geological features, is beautifully symmetrical. It terminates at both ends in mountain ridges, these ridges sinking away with the two extremities of the fold. The denuded part, (Sequatchee valley being the northeastern end, and Brown's Valley the southwestern,) is a canoe-shaped, beautiful trough, in which are small characteristic ridges and valleys. This trough has a rim of Coal-Measures all around it."

The Coal-Measures which cap the high plateau separating Brown's Valley from the Basin of the Tennessee in North Alabama, appear nowhere to be very thick, so that none but the Lower Measures appear to be exposed in this area. The Conglomerate, which is near the bottom of the series, is the surface rock in places, from the Tennessee river west of Guntersville down to the center of Winston county.

This part, therefore, of the Warrior field might with propriety be considered as a part of the Cumberland Table-Land.

The seams of coal below this Conglomerate, two or three in number, are in Tennessee the most available for the production of coal. In Alabama, however, their thicknesses are quite variable.

In Alabama the geologically lowest rocks seen in the val-

are the limestones of the Sub-Carboniferous formation, ept at Blount Springs, near Scottsboro, Stevenson, and in w other localities where the underlying Silurian rocks are osed, over small areas.

DETAILS.

he geological relations of the counties through which the ey extends are quite simple. The lower strata of the l-Measures, including several seams of coal, form the sur- over the whole area, except where removed by denuda-, 1st, in Brown's Valley, and 2d, in the subordinate valleys oves which have been cut by small streams, back into the of Coal-Measures which bounds Brown's Valley on each .

Blount and Marshall counties, the edges of the valley very slightly indented, and the same is true of the eastern in Jackson, but the western rim in the last named coun- is so deeply gapped by coves which extend back for y miles, that the symmetry of the valley is almost lost. ust above Stevenson the railroad passes near the foot of of the mountain spurs which bound the valley on the . The slopes of this mountain are formed of the lime- es of the Chester or Mountain Limestone Group.

ear the summit of the mountain and beneath a bed of dstone or conglomerate, which forms a series of cliffs nd the mountain, is a seam of coal which has been ked in two or three places.

or the purpose of giving a fair presentation of the meas-, as exposed upon the mountain spurs west of the Ten- ee river valley in Jackson, I will add here a section made Dr. James M. Safford in the valley of Crow Creek, near erson Depot on the Nashville & Chattanooga road, and the Alabama line:

2.) CONGLOMERATE, coming in back of the top of the cliff formed by the sandstone below.

1.) COAL *and shale;* coal so far as seen only eight or ten inches.... 40 feet.

(10.)	SANDSTONE, heavy, makes the *cliff:* thickness (estimated)	120 feet
(9.)	COAL, from 2 to 5 feet of lustrous, black, good coal, more or less laminated by thin leaves of mineral charcoal; contains some pyrite occasionally in seams. The coal will perhaps average	3 feet
(8.)	FIRE CLAY	3 "
(7.)	SHALE	8 "
(6.)	SANDSTONE	10 "
(5.)	COAL? *and shale*	10 "
(4.)	SANDSTONE *and Sandy Shale*	55 "
(3.)	Shale	1 to 6 "
(2.)	COAL, has been opened, a laminated, cubic coal, without pyrite, will average, so far as seen, from	2½ to 3 "
(1.)	*Shale*, with clay iron stones, followed below by rocks not seen.	

In this connection Prof. Safford says, "The second coal below the conglomerate (bed 9), has been and perhaps is now worked at several points below Anderson. Its average thickness is considerably less than three feet. Occasionally it is above this, and at one point in Alabama, not far below the Tennesse line, it measured *seven* feet, soon, however, running down to two."

Further southwest, in the vicinity of Larkinsville, the measures have been pretty thoroughly tested with the diamond Drill, by Messrs. DeBardeleben & Co. These drillings show that the seam is extremely variable in thickness.

The floor of the valley in Jackson county is mostly formed by the strata of the lower or Siliceous division of the Sub-Carboniferous formation. In the coves between the spurs of the Cumberland Mountains the St. Louis Limestone is the principal surface rock, whilst in the immediate valley of the Tennessee (Brown's or Sequatchee valley) the lower group of the Siliceous division is seen, and, in places, even the underlying Black Shale and Silurian rocks are exposed.

Near Stevenson, as is also the case beyond Guntersville to the end of the valley at Reid's gap, a ridge composed prin-

ally of chert divides the valley longitudinally into two rts. Upon this ridge, everywhere, limonite is found, which casionally is pure enough and in sufficiently large quantity constitute valuable ore-banks.

Generally, however, the limonite is too much mingled with ert, in all stages of decay, to be of much value.

In section 31, township 1, range 3, are occurrences of fos-iferous limestones of greenish and reddish colors. These, en worked up, take a fairly good polish, and might well be ed for mantles and other articles of the kind.

Near Warrenton the western rim of the valley is formed in eat measure of a conglomerate, a mass of quartz grains mented together, and enclosing rounded pebbles of white artz, about the size of peas. Above the conglomerate are ndstones and shales of the usual character, and below it, st, shales and sandstones with one or two thin coal seams, d then the shaly and cherty limestones of the Sub-Carbon-rous Formation.

Near Guntersville the eastern rim of the valley is Sand ountain, which, like the rim on the western side, is made of the Sub-Carboniferous limestones below, and the con-omerate, sandstones and shales of the Coal-Measures above. n both sides, the strata of the Coal-Measures lie in nearly rizontal position, with a slight dip *away* from the valley, rming in this way a table land or plateau.

In the following descriptions, it will be convenient to vide the valley between Guntersville and Reid's Gap into o halves, the one extending from Guntersville to within or 8 miles of Blountsville, and the other from the latter int to Reid's Gap. At the point indicated, there is a divide tween the waters flowing northeast into the Tennessee, d those flowing southwest into the Warrior. At this viding line the surface rocks are sandstones, either of the pper part of the Sub-Carboniferous formation, or of the wer Coal-Measures. The height of the water shed (where e road crosses it), above the river at Guntersville, is not ss than 375 feet.

Near this point two creeks, flowing northeast, have their sources—Brown's Creek on the west, Gunter's Creek on the east. They flow parallel to each other and about one and a half miles apart, into the Tennessee. A ridge of chert, the débris of the cherty limestones which form the general floor of the anticlinal valley, separates the two creeks and the two valleys through which they flow. It is worthy of remark that in the anticlinal valleys further southeast, particularly Murphree's and Jones' valleys, chert ridges formed of débris of *lower Silurian* cherty limestones, divide those valleys in the same way, and the chert ridge in Jones' valley certainly, and perhaps in Murphree's valley also, follows the line of a *fault.*

In Gunter's valley, the cherty limestones of the Lower or Siliceous Group of the Sub-Carboniferous formation make the greater part of the surface. The Mountain Limestone is confined to the slopes of the Sand Mountain. It seems hardly possible to make out in this valley the subdivisions of the Siliceous Group. From the occurrence, however, of numerous sink holes and big springs, it seems probable that the St. Louis limestone is the principal surface rock.

The prevailing soil in Gunter's Creek valley, is of deep red color, and fertile; along the sides of the chert ridge and near the head of the valley, the soil is more sandy, gray in color, and less fertile.

Southwest of Brooksville, beyond the transverse dividing ridge alluded to above, the drainage is southwest into the two Warriors, a chert ridge dividing the valley longitudinally into two parts. Blountsville lies on the northwestern side of this chert ridge, and the valley at this place is quite narrow. Below Blountsville the ridge rises to a considerable height, and there are several peaks which, according to the measurements of the United States Coast Survey, attain an altitude above the sea of more than 1200 feet.

CHAPTER IV.

THE WARRIOR COAL FIELD.

ncluding under this head all the Coal Measures of Ala-
na, drained by both forks of the Warrior and their tribu-
ies,the Warrior Coal Field may, for convenience, be di-
ed into two parts—the *Plateaus or Table Lands*, and the
rrior Basin proper.

'he *Table Lands* may be again subdivided into two parts;
one lying between the Great Sequatchee fold (Brown's
lley) and the limestone valleys of North Alabama, and in-
ding parts of the counties of Marshall, Morgan, Blount,
rly all of Cullman, and the eastern half of Winston, with
haps a small portion of the north-east quarter of Walker;
other, between Brown's and Wills' Valleys, comprising
coal areas on each side of Murphree's Valley, and includ-
parts of the counties of Marshall, Blount and Jefferson.
ese may with propriety be considered as extensions into
abama of the Great Cumberland Table Lands and Walden's
dge of Tennessee.

The height of these Plateaus diminishes continuously
vards the south-west, the Plateaus passing gradually into
Basin proper. In Tennessee the elevation of the Plateau
ove the surrounding county varies from 850 to 1000 feet.
Jackson and Madison counties some of the spurs attain
equal height, but further southwest in Morgan and Mar-
all, the elevation will average not more than 550, and in
llman and Blount counties not more than 300 feet above
general level of the country.

It is characteristic of the Plateaus that the limestone beds
ich underlie the capping of Coal Measures rocks, are *above*
e general drainage level of the country. This arrange-
ent of the two classes of strata determines in great measure
e character of the scenery, for the removal by erosion of

the more perishable limestones, causes the undermining of the harder sandstones above, which from time to time, break off with vertical faces, forming cliffs. From the same circumstance, the streams flowing out into the valley towards the west and north, have cut back into the tablelands, deep coves, the length of which depends, amongst other things, upon the thickness of the limestones above the drainage level. For this reason, the length of the coves diminishes towards the south-west. The Plateaus are nowhere cut entirely through by streams, except by the Tennessee below Guntersville.

The rim or margin of the table lands is generally only slightly indented by the streams, except on the western edge in Jackson and Madison, and on the northern edge facing the Tennessee valley in Morgan, Lawrence, and Franklin counties. The outline especially in Jackson and Madison counties of this western face of the Plateau is extremely jagged and irregular.

Of the character and extent of the coal seams occurring upon the Plateaus, something has already been said above, under Madison, Morgan and Marshall counties. The coal seams are all of the lower series, amongst them, one or two of workable thickness. Near Stevenson, Larkinsville, Huntsville, Oleander, on Short Creek, and at a few other localities, one or the other of these seams has been worked on a small scale, and there can be no doubt that further examinations will bring to light other localities when the thickness of the coal will allow it to be worked with profit.

At present, however, lack of means of transportation stands in the way of the working of these beds except in a few localities. The position of the seams, high above the water level of the country is favorable to mining.

The *Warrior Basin*, includes parts of Jefferson, Tuscaloosa, Walker, Winston, Marion and Fayette counties, drained by the Warrior. Tributaries of the Tombigbee, however, drain part of this area in Fayette and Marion counties, and a

all tract in contiguous corners of Marion, Winston, and anklin counties, is drained by Big Bear Creek into the nnessee. The average elevation of the land above the incipal water courses is from 200 to 250 feet, the height ove sea level it is not possible at present to give.

From the facts that the measures sink gradually towards e south and west, and that the Sub-Carboniferous lime-ones in these directions, not only sink below the general rface, but actually thin out, as is seen in the section ex-sed in the anticlinal valleys, Jones', Roup's, &c., it is evi-nt that no sharp line of division can be drawn between the ble lands and the Basin. For convenience we may assume, rovisionally at least) that the Table land extends south nad st as far as the lower conglomerate appears as a surface ck, and where none but the lowest seams of the Coal easures are exposed. This would class the measures of ount, Cullman, and the northeastern parts of Jefferson and inston with the *Table lands*, and south and west of these nits would be the *Basin* proper.

As Brown's Valley divides the Plateau into two parts, so e continuation of the valley as an anticlinal fold for twenty-e or thirty miles south-west of Reid's Gap, divides the sin into two unequal parts. South-west of the confluence the Warriors these two parts seem to come together in e common basin, by the sinking away of the anticlinal fold ich separates them higher up.

Our knowledge of the Warrior Basin is quite limited; the rrow belt lying between the Warrior River and Jones' lley in the northwestern part of Jefferson county, is the ly portion about which these is any reliable information ncerning the number of coal seams, their thicknesses, and eir relations to the interstratified rocks, and this part of e field has been systematically explored only along the line the South and North Alabama Railroad, and west of irmingham.

In Tuscaloosa county, near the Alabama Great Southern ailroad, Coal has been mined in several localities ; so, also, ear the town of Tuscaloosa.

The northwestern part of the basin, including Walker, Winston, Fayette and Marion counties, is, so far as a knowledge of the Coal Measures goes, practically a *terra incognita*.

Railroad surveys have been carried through this region, and incidentally the outcrops of coal seams near the lines of the surveys have been noticed. A geological reconnoissance has been made through the counties named, and occurrences of coal noted; partial explorations in the interests of companies and of individuals have been made, but the data thus collected are neither sufficiently numerous nor sufficiently connected to be used in the construction of a reliable geological section of that part of the field. A proper exploration of this area would require the expenditure of a large amount of money and several years work.

In this report I shall endeavor to give as well as possible the present state of our knowledge of this basin, and since it is not possible to give a general description of the entire field, I shall give merely some details of the counties included in this area.

JEFFERSON COUNTY.

In a former report, I published the results obtained by
ring with the diamond drill, at several localities in the
utheastern part of the Warrior field, along the line of the
& N. Ala. R. R., and in the vicinity (west) of Birmingham.
The labors of Mr. T. H. Aldrich, to whom I am indebted
r the facts given below, have brought to light the connec-
ons between these drillings, and have rendered possible the
nstruction of a section of this part of the Warrior field,
hich is approximately correct.

A section from Jones' Valley, above Birmingham, to
rown's Valley, along the line of the S. & N. Ala. R. R., in-
udes that part of the Warrior field which has been most
tensively worked for coal, and which is therefore best
nown. This section, as showing the geological relations of
e strata of Jones' and Brown's Valley, as well as those of
e Coal-Measures, is an instructive one.

Jones' Valley, as has been mentioned in previous reports,
divided longitudinally by a ridge made up of chert frag-
ents, the débris of the cherty limestones of the Knox Dol-
mite or Quebec formation of the Lower Silurian. This
dge, for a part at least of its length, marks the position of
fault by which Upper and Lower Silurian are brought into
ntact.

A reference to the map published in my report for 1876,
ill show that the Clinton group of Upper Silurian, and, in
me instances, the Black Shale, and even the Sub-Carbonif-
rous limestone, have been involved in the faulting, and
rought up the level of the Quebec Dolomite, in the valley
elow Elyton. The same condition of things obtains further
orth above Birmingham, and the line of fault is there also
marked by the chert ridge.

West of this ridge, the strata have been overlapped, so that they all dip one way, *i. e.* southeast; but the newer formations lie *beneath* the older. In crossing the western part of the valley, therefore, going towards the Warrior field, we pass over the upturned edges of the strata (all dipping southeast) of the formations, in the following order:

	Lower Silurian	(1) Quebec or Knox Dolomite with chert. (2) Chazy and Trenton limestones.
	Upper Silurian.	(3) Clinton Sandstones and Red Hematite Ore.
Sub-Carboniferous.	*St. L. Limestone, etc.*	(4) Sub-Carboniferous cherty limestones, &c.
	Chester Group	(5) Heavy bedded sandstone, siliceous, glist'ng in the sun. (6) Limest'ne with *Pentremites* and other Sub-Carb. fossils.
	Coal Measures.	(7) Shales. (8) Heavy bedded siliceous, glisten'g sandstone, in nearly vertical ledges, forming the high rocks on each side of the railroad at Boyles Gap. (9) Shales and sandstones of the Warrior basin.

A moment's reflection will show that, with southeast dips, the formations are reversed, so that the Quebec overlies the Chazy and Trenton formations, and these in turn, the Clinton and Sub-Carboniferous.

The beds of limestone, No. 2, may be traced for a long way up and down the valley, where their up-turned edges, in many places, form a series of low walls, running northeast and southwest. No. 3, at this place, is not well shown, but south of the railroad the red ore becomes much more conspicuous.

No. 4 (the Siliceous group), also near the railroad not very well shown, though easily recognizable. Further south, Nos. 3 and 4, with the Black Shale between them, form a conspic-

us ridge, the counterpart of the Red Mountain ridge on
e other side of the valley. No. 5, from its position, is,
th very little doubt, to be referred to the Mountain Lime-
one or Chester Group. It is probably the representative
that sandstone layer in the Mountain Limestone which,
North Alabama, plays so conspicuous a part in the
enery. (See further details under Franklin and Lawrence
unties.)

No. 6, also a member of the Chester or Mountain Lime-
one group, is well shown in the low places on each side of
e railroad.

The remainder of the section, Nos. 7 and 8, may probably
referred with No. 9 of the Coal-Measures.

The heavy bedded siliceous sandstone, No. 8, has usually
en called (adopting Prof. Tuomey's nomenclature), Mill-
one Grit. It rises in nearly vertical ledges, forming a con-
icuous ridge on the western side of the valley down to its
mination southeast of Tuscaloosa.

It is everywhere, in the anticlinals of Middle Alabama,
und near the base of the Coal-Measures; but in the north-
n part of the State, it is often much less conspicuous. It
ems probable that the line between the Mountain Lime-
one and the Coal-Measures, should be drawn between No.
and No. 7 of above section.

The thickness of the sandstone No. 5, is about 60 feet, and
e dip 28° to southeast.

The limestone, No. 6, with shales No. 7, are together 75
et thick. The siliceous sandstone, No. 8, is 120 feet in thick-
ss, and dips 45° to southeast.

Continuing, now, the section along the railroad, *inside* of
e rim of sandstone which makes Boyles' Gap, we find the
ual sandstones and shales of the Coal-Measures. These
ds, for a distance of 1,000 feet or more across the strike,
ow evidences of great disturbance, dipping at high angles,
e prevailing dip being southeast. Within these nearly
rtical measures, which include one or two seams of coal,
ere is a sharp anticlinal fold, the strata on both sides be-
g nearly perpendicular. On the western edge of this nar-

row strip of highly inclined strata, is a *fault*, beyond which begins the great basin of this part of the field. Immediately beyond this fault, the measures dip 35° *northwest*, falling off within a few hundred feet, to a dip of 13°.—(Aldrich.)

The rest of the section, across the field to Reid's Gap, I take from an article written for Berney's Hand Book of Alabama, the notes for which section were kindly furnished to me by Mr. Aldrich.

"The railroad, after entering the basin, follows very nearly the line of the strike of the strata for about two miles, the dip being from 8° to 15° northwest throughout this distance; then a fold in the rocks brings to the surface the 'Warrior,' 'Black Creek,' and the 'Jefferson' seams of coal.

The openings of the Coalburg Mining Company, Thos. Sharp, Superintendent, are situated near centre of S. 3?, T. 16, R. 2, W. The slope is about 350 feet deep (1877) and is sunk upon the Black Creek seam, though some doubt seems to exist here as to which seam should bear the name of Black Creek.

The section in the vicinity of the slope would be as follows:

(11.)	Shale and Sandstones	75 ft.	00 ins.	
(10.)	COAL (bands of Slate)	00 "	20 "	
(9.)	Slate, etc	40 "	00 "	
(8.)	COAL	00 "	12 "	Jefferson Seam.
(7.)	Slate	00 "	10 "	
(6.)	COAL	00 "	12 "	
(5.)	Sandstone	14 "	00 "	
(4.)	COAL, good	00 "	16 "	*Unknown Seam.*
(3.)	Slates and Sandstones	35 "	00 "	
(2.)	COAL	19 "	24 "	*Black Creek Seam.*
(1.)	Sandstones, &c			

The slope at Coalburg starts at a dip of about 35°, and soon falls off to the very low one of 8°."

"The railroad continues still nearly on the strike of the strata, for three miles, to Newcastle Station, where the mines of the Newcastle Company, Jno. T. Milner, Superintendent, are situated.

section of the measures at this point, compiled from ings and other data, is nearly as follows, beginning above :

AL.	5	ft.	8	ins.	*Newcastle Seam.*
ndstones, &c.	15	"	0	"	
AL.	0	"	22	"	
e Clay.	3	"	0	"	
ndstones, &c.	20	"	0	"	
AL.	2	"	6	"	
ndstones, &c	25	"	0	"	
ACK BAND IRON ORE.	1	"	4	"	
ndstones, &c.	20	"	0	"	
AL.	4	"	9	"	
ndstones, &c.	25	"	0	"	
NGLOMERATE	16	"	0	"	
ndstones, &c	130	"	0	"	
AL.	0	"	18	"	
ndstones, &c.	50	"	0	"	
AL, (slate in the middle).	2	"	2	"	*Jefferson Seam.*
ndstones, &c.	9	"	0	"	
AL.	1	"	6	"	
ndstones, &c.	4	"	0	"	
AL.	0	"	9	"	
ndstone.	50	"	0	"	
AL.	2	"	4	"	*Black Creek Seam.*
ndstones, &c.					

The Newcastle seam may be seen outcropping on the west le of the little valley; the dip is about 5° to northwest.

An analysis of coal from this seam may be found in my port for 1875, pages 39 and 63, together with details con- rning the mine. When washed, this coal makes an excel- nt coke, but on account of the shale in the seam it is not w worked; the underlying Black Creek seam is the one om which coal is now raised at Newcastle. This seam is ached from the railroad, by a tramway 1200 feet in length. ne average thickness of the seam is 32 to 33 inches, and the p like that of the Newcastle seam, 5° to northwest. The am is underlaid by fire clay; the roof is also clay, and is oted for the beautiful fern impressions contained in it.

Analysis of Black Creek Coal, by PROF. N. T. LUPTON.

Specific gravity	1.3[illegible]
Moisture	1.5[illegible]
Volatile Matter	31.7[illegible]
Fixed Carbon	64.7[illegible]
Ash	1.5[illegible]
Sulphur	.3[illegible]

The evaporating power of the coal, from experiments made in Louisville, Ky., is 8.01 lbs. of water to the pound of coal. As a gas coal it is excellent. A statement from Geo. H. Wells, of Nashville, now before me, shows that it yields 4.8[illegible] cubic feet of gas per pound of coal, and 33½ bushels of screened coke per ton. The output of the mines is 100 tons per day.

The seam of black band iron ore seen in the above section is worthy of notice. It outcrops close to the railroad, a short distance north of the station."

"A quarter of a mile above Newcastle Station, there is a great fault, 800 feet or more in width, and having an east and west direction. Nothing is known of the relations of this fault to the great field, except that it has been traced several miles from the road.

Crossing this fault, we are in the central part of the basin. The rocks here are perfectly horizontal for several miles, and no developments have been made."

"At Jefferson Mines, 10 miles above Newcastle Station, is the shaft of the Jefferson Coal Company, Marshall Morris, Superintendent. This shaft is 200 feet in depth, starting above the conglomerate (of the foregoing section,) and passing through the Jefferson down to the Black Creek seam. A section of the shafi is about as follows:

COAL, poor, full of slate	4 ft.	9 in.
Clays and sands	21 "	1 "

NGLOMERATE	16 "	0 "	
te	1 "	0 "	
AL, with shale	1 "	6 "	
ndstones, clay, and shales	81 "	10 "	
AL, good, hard	1 "	6 "	
ndstones	40 "	6 "	
AL, good	3 "	3 "	*Jefferson Seam.*
ndstones, &c	29 "	5 "	
AL, good	2 "	6 "	*Black Creek Seam.*
ndstones			

The *Jefferson seam* in this shaft, shows a thickness of about inches, and has a good roof.

The *Black Creek seam* is more irregular, running from two d one-half to three and one-half feet, but has no shale rtings, and is said to be at this point the best iron making l yet found on the road.

The Eureka Company is using a considerable quantity of s coal in the furnaces at Oxmoor."

' Half a mile north of this mine, the Warrior river is crossed the railroad, and beyond the river, begins the northwest e or edge of the basin. Here the measures rise about two t in one hundred, up to Warrior station, four miles rth of the river.

At this point the Warrior seam is extensively worked by . Jas. T. Pierce, and by the lessees of the Alabama Mining d Manufacturing Company, Mr. Frank Hoene, Superinndent.

The section at this point, as given by borings, is :

ndstones and clays with fossils	85 ft.	6 in.	
AL	1 "	2 "	
NNEL COAL AND BLACK BAND	2 "	4 "	
ate, hard	4 "	0 "	
AL, average thickness	2 "	9 "	*Warrior Seam.*
ays, sandstones, &c			

The strata under the Warrior seam, are given below in the neral section of the field, as compiled from borings.

The seam dips very slightly, and drifts are run in all along

the outcrop. The coal is excellent, and is used on the engines of the S. & N. Ala. R. R.

Mr. Jas. T. Pierce works one shaft with capacity of 100 tons a day, and four slopes capable of an output of 150 tons a day.

The Alabama Mining and Manufacturing Company, Mr. Hoene, Superintendent, work three openings with one main entry, and several east and west entries. Capacity of the mines, 120 to 150 tons per day. From the mouth of the entry the coal is hauled by steam power up an incline, and thence by a tramway one-eighth of a mile long to the weighing house; it is then dumped directly upon the cars of the S. & N. Ala. R. R., near the station.

The coal enjoys an excellent reputation, especially for domestic and steam purposes. The seam averages about three feet in thickness, the dip about 18 in 100 to southeast. Roof, hard slate about four feet thick, above which is the stratum of black band and coal, two feet six inches thick. Above the black band is sandstone. Below the coal is fire-clay, four feet thick, the first foot gritty, the rest good clay."

"Going north of Pierce's station, where the outcrops of the Warrior seam rise to the surface, we cross a long series of sandstones and shales to Reid's gap, where the glistening siliceous sandstone, often called millstone grit, and the other accompanying strata are repeated, and we come then to the valley of Blount Springs (Brown's valley)."

In the foregoing sections, the Newcastle is the topmost seam.

Recent researches of Mr. T. H. Aldrich have shown that southwest of the S. & N. Ala. R. R. a series of coal seams comes in above the Newcastle, and he has worked out the relations of these seams so that it is possible to give an approximately accurate section of the Warrior Basin in this part of the State.

If we refer back to the descriptive section along the S. & N. R. R., it will be seen that inside of the ridge of siliceous sandstone through which the railroad passes into the Coal

sures at Boyle's Gap; the measures show evidences of
ng been much faulted—they stand nearly vertical in
places—and about 1,000–1,500 feet northwest of this
across the strike, occurs a fault beyond which the
sures are nearly horizontal, being slightly upturned near
dge of the fault.

uthwestward this fault does not appear to run parallel
with the edge of the Coal Field, but makes an acute
with it, so that if its direction continued the same, it
d intersect the edge of the Coal Field, perhaps eight or
niles southwest from Boyle's Gap, the strip of faulted
ures thinning out between.

ong the S. & N. Ala. R. R. the strata of the great basin
orthwestward, but a few miles further south, the dip
ges slightly more to westward, and the series of upper
s comes in. These upper seams appear to lie in a sort
sin, for their outcrops, instead of running parallel with
dge of the Field, bear away towards the north and
The limits of the basin and the area underlaid by
upper seams, are not yet made out, except in the im-
ate neighborhood of the Pratt Mines, and thence south-
.

the north half of northeast quarter of S. 30, T. 17,
west, the PRATT COAL & COKE COMPANY have sunk a
upon what is known further to the southwest as the
n seam. The section of this seam is as follows:

....	Slate.
....	10 inches.
....	2 "
....	46 "
....	

e coals from both benches of this seam, together with
wo inches of slate between, have been analyzed by Mr.
y McCalley, in the Laboratory of the Survey. The re-
are as follows:

1. *Analysis of average sample of coal from upper bench of Pratt Coal and Coke Company's Seam.*

Specific gravity	1.33
SULPHUR	1.224
Moisture	1.479
Volatile Combustible Matter	32.283
Fixed Carbon	59.503
Ash	6.735
	100.000

2. *Analysis of average sample of coal from lower bench of Pratt Coal and Coke Company's Seam.*

Specific gravity	1.273
SULPHUR	.612
Moisture	1.529
Volatile Matter	30.685
Fixed Carbon	63.683
Ash	4.103
	100.000

3. *Analysis of the slate parting between upper and lower benches of Pratt Coal and Coke Company's Seam.*

Proximate Analysis.

Specific gravity	1.986
Moisture	1.621
Volatile Matter	11.719
Fixed Carbon	23.839
Ash	62.821
	100.000

Analysis of the Ash of above Slate.

Silicic Acid	63.155
Ferric oxide	6.385
Alumina	22.884
Lime	.706
Magnesia	.536

ash	2.164
la	1.143
osphoric Acid	2.564
phuric Acid	.145
phur, combined	.051
orine	Trace.
	99.728

—

he dip of the seam at the slope is $4\frac{1}{2}°$ to the northwest, northeast of the mine the dip of the seam changes more l more towards the west, and the line of outcrop, at the ne time, turns from northeast towards the north, showing edge of the basin.

he improvements at the mine are, a shoot 140 feet long, h tracks for each grade of coal.

double hoisting engine, of 40 horse power.

wo hoistways and manway in slope.

ifty coke ovens 12 feet in diameter, now building. It is posed to build 150 in all.

aily output at present, 206 tons; capacity of the mine, tons per day.

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give below a general section of the Warrior basin in s locality. For the section, from the top down to the wcastle seam, I am wholly indebted to the kindness of T. H. Aldrich, who has carefully explored this part of field, and made out the relations between the upper and ver series.

rom the Newcastle seam downwards, the section is comed from borings, made with the diamond drill, in various ts of the field, and especially from examinations made ng the South & North Alabama R. R. For this, also, I in great measure indebted to Mr. Aldrich.

his is probably as near an approach to an accurate secn of the Warrior basin, southeast of the Brown's Valley ticlinal, as can be made with the data at present available.

General Section of the Warrior Basin, west of Birmingham, Jefferson County.

Surface soil, of variable depth			
COAL, *Guide Seam*	0	feet,	3 in.
Sandstones, shales, &c	115	"	0 "
COAL, *Pratt Seam*	4	"	8 "
Sandstones, &c	20	"	0 "
COAL, *Sixteen Inch Seam*	1	"	4 "
Sandstones, shales, &c	30	"	0 "
COAL	2	"	4 "
Sandstones, &c.	5	"	0 "
COAL, *Four Foot Seam*, in two benches of equal thickness, with 8 inch slate parting	4	"	8 "
Sandstones, shales, &c	50	"	0 "
COAL, *Quadruple Seam*	6 or 7	"	0 "
Sandstones, and other measures	20 to 30	"	0 "
COAL, *Slaty Seam*	1	"	6 "
Sandstones, &c	35	"	0 "
COAL, slaty, one bench 2 feet thick	8	"	0 "
Sandstones, &c	100	"	0 "
COAL, *Double Seam*, two seams 8 in. and 15 in., with 5 feet of shale, &c., between	7	"	0 "
Sandstones, &c	100	"	0 "
Shales	25	"	0 "
COAL, good	4	"	6 "
Sandstones, &c	25 to 30	"	0 "
COAL, small seam	1 to 2	"	.. "
Shales, &c	6 to 10	"	0 "
COAL, in two benches of 3 and 15 inches, with 2–3 feet of slate between	4	"	0 "
Sandstones, &c	100	"	0 "
COAL	2	"	2 "
Shales, and other measures	50	"	0 "
COAL, double seam, thickness not known.			
Sandstones, shales, &c	300	"	0 "
COAL, *Newcastle Seam* (slaty) ......5 ft. 8 in. to	6	"	3 "
Sandstones, &c	15	"	0 "
COAL, poor	1	"	10 "
Fire clay 3 feet, and sandstones 20 feet	23	"	0 "
COAL	2	"	6 "
Sandstones, &c	25	"	0 "
BLACK BAND IRON ORE	1	"	4 "
Sandstones	20	"	0 "
COAL, poor, full of slate	4	"	9 "
Fire clay and arenaceous clays	20–30	"	0 "

GLOMERATE	16–20	"	0	"
L, with shale	1	"	6	"
dstones, shales, &c.	81	"	10	"
L, good, hard	1	"	6	"
dstones	40	"	6	"
L, good, *Jefferson Seam*	3	"	3	"
dstones, &c	29	"	5	"
L, good, *Black Creek Seam*	2	"	6	"
dstones, &c	139	"	0	"
L, doubtful	1	"	6	"
dstone, with fossil shells	85	"	0	"
L	1	"	2	"
dstones, &c	30	"	0	"
NEL COAL AND BLACK BAND	2	"	4	"
e, hard	4	"	0	"
L, good, *Warrior Seam*	2	"	9	"
ys, sands, &c	20	"	5	"
L	1	"	8	"
y and sandstone	7	"	6	"
L, hard	2	"	2	"
le, sandstone, &c	295	"	6	"
L, hard and bright	1	"	6	"
dstone and fire clay	17	"	0	"
L	1	"	4	"
les, with coal plants	12	"	0	"
L, good	2	"	6	"
dstones, clays, &c	102	"	7	"
les and sandstones, with two thin seams of coal near bottom of series	450	"	0	"
ceous Sandstone, base of Coal Measures	100	"	0	"
-CARBON-FEROUS. Shales	80	"	0	"
Limestone, with *Pentremites*	75	"	0	"
Siliceous Sandstone	60	"	0	"

TUSCALOOSA COUNTY.

Although coal has been mined in the vicinity of Tuscaloosa for many years, there has been no systematic exploration of the Coal-Measures of the county.

Under the auspices of the Tuscaloosa Mining and Manufacturing Company, a number of sections of coal seams were made in several places on the tributaries of Davis', Daniels', and Hurricane Creeks. It may be of interest to give some of these sections, as illustrating the character of the coal beds eighteen or twenty miles northeast of Tuscaloosa.

Together with these measurements I will give those of beds in other localities where coal has been dug for local use.

In S. 5, T. 21, R. 7, W., near the center of the section, and on land belonging to Mr. Martin Williams, a thin seam of coal, 10 inches thick, has been worked to supply the forges of the vicinity.

In the NW of NE of S. 8, adjoining, another opening, upon what may be the same seam, the thickness, however, being a little greater, 12–13 inches.

Also, in the SE of NW of S. 9, same township and range, is another bed, 25–30 feet above the two just named. The coal here is said to be 16 to 18 inches thick, a good hard coal.

Upon a tributary of Little Hurricane Creek, in S. 1, T. 21, R. 8, W., there are three beds separated by 25–30 feet of intervening strata; the uppermost of these is called the Lawrence bed—said to be about 3 feet thick; 25 feet below this, the Ball bed, thickness not determined; and 25–30 feet lower, the Phelan bed, 3 feet thick, lying under a conglomerate.

n the same section, on J. D. Hamer's land, an outcrop of l was seen, about 3 feet in thickness, with some shale.

n section 2, on Mr. Peterson's and on Mrs. L. C. Garland's d, a seam of about the same thickness has been worked; haps the same bed. The bed at Hamer's has immedi- ly over it four feet of fire-clay, and over the clay a con- merate, of which four or five feet are exposed. The Pe- son bed has over it, also, fire-clay overlaid with conglom- te.

'his bed shows very little shale, almost none, and the coal 27½ inches in thickness. The Garland bed, S. 2, T. 21, 8, W., is probably the same.

North of these localities, in T. 20, R. 8, W., are also sev- l beds where coal in small quantities has been mined. In NW of SE of S. 36. T. 20, R. 8, W., a bed 18–24 inches ck has been worked by Mr. Toxey; the quality of the coal good, and the roof is of sandstone.

n the NE of NW of S. 35, adjoining, a bed 2 feet thick been opened, and in SW of SE of S. 26, like the pre- ing, on land belonging to Mrs. L. C. Garland, another bed, wing about 3 feet of coal, has been opened and worked. s coal enjoys an excellent reputation, having been mined e and sold in Tuscaloosa. This is sometimes called the llett bed, and it is separated from the bed in S. 35, above ntioned, by 30 feet of Measures.

East of these openings, others have been made in Town- p 20, Range 7.

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n the northeast corner of section 9 of this township, and southwest corner of section 18, two outcrops have been urately measured. The first is called *Burchfield No. 1*, other the *Haldman bed;* from the similarity of the two tions it seems probable that the bed is the same:

	No. 1.	No. 2.
Sandstone Roof........	....	....
COAL.................	13 inches.	17 inches.
Slate	3 "	2 "
COAL.................	9 "	9½ "
Slate	2 "	1½ "
COAL.................	7½ "	10 "
Slate	2½ "	½ "
COAL.................	15 "	12 "
Fireclay.............	22 "	36 "
COAL.................	19 "	28 "
Fireclay.............	....	....

In section 19 of same township, the following measurements were made:

Surface..........................		Burchfied No. 3.
COAL.............	1 foot 3 inches.	
Shale.............	0 " ½ "	
COAL.............	0 " 6 "	
Shale.............	0 " 1 "	
COAL.............	1 " 7½ "	
Fireclay..........	not determined.	
Sandstones, &c.	. 20 feet 4 inches.	
COAL..............	2 " 4 "	Burchfield No. 2.
Fireclay..........		

These two beds have been called *Burchfield beds No. 2 and 3.*

In the southeast corner of section 30, same township, we get the following section of what is called the *Jones bed:*

Roof—shales...............	
COAL........	0 feet 9 inches.
Shale........	0 " 7 "
COAL........	0 " 10 "
Fireclay.....	3 " 6 "
COAL........	1 " 7 "
Shale........	0 " ½ "
COAL........	0 " 11 "
Shale........	0 " 1 "
COAL........	1 " 3 "
Fireclay.....	

In section 27, township 20, range 7, east of the foregoing

crop, the following measurements were made of what is led the *Hart bed:*

Sandstone Roof................			
COAL............	1 foot	8	inches.
Slate...........	0 "	1	"
COAL............	0 "	7½	"
Slate............	0 "	1	"
COAL............	0 "	9	"

ome distance down the branch from this outcrop, another has been exposed, which was measured as follows, *Thom-ed:*

Sandstone Roof................			
COAL.........	1 foot	7½	inches.
Slate.........	0 "	1	"
COAL.........	1 "	1	"
Fireclay......			

---

bout 15 feet below this, and separated from it by shales, small seam 2–4 inches in thickness.

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n Brushy Creek, several small seams have been observed, h lie between the beds above given and the Warrior level.

is, of course, not possible to give with certainty a sec- of the strata as exposed in this part of the county, but ny attempt to reduce to order, the various observations ady made, is worthy of attention, I make no apology ntroducing here, a section which was constructed by Bowen, of Pennsylvania, whilst exploring in the interest he Tuscaloosa Mining and Manufacturing Company. lst this section may be faulty in some particulars, it is ably, upon the whole, approximately correct.

Section of the Coal-Measures in Township 20, Ranges 7 and 8, Tuscaloosa County.

	Surface Rocks	40 to 100 feet.
	COAL. Cleveland bed (?)	2 " 4 inches.
	Sandstones, &c.	40 " 0 "
	COAL. (Jones', Harts', Burchfield No. 3.)	3 to 3 " 8 "
	Measures	20 " 0 "
	COAL. (Peterson's and Burchfield No. 2.)	2 " 4 "
	Measures	25 " 0 "
	COAL. (Thomas' 2 ft. 9 in. Burchfield No. 1, Haldman,)	6 " 6 "
	Shales	15 " 0 "
	COAL	0 " 2-4 "
	Measures (estimated)	30 " 0 "
Exposed on Brushy Creek.	COAL	0 " 10 "
	Sandstones, &c.	150 " 0 "
	COAL	0 " 3 "
	Measures	10 " 0 "
	COAL	0 " 10 "
	Sandstones, &c.	100(?) " 0 "
	COAL	0 " 4 "
	Water level Warrior River.	

On the opposite (west) side of the Warrior, there have been fewer explorations for coal, and less is known about that part of the county.

North River and the Warrior, for fifteen or twenty miles before their confluence, flow approximately parallel to each other, the two rivers being separated by a ridge of denudation, the summit of which is more than 300 feet above the water level at the point where the two come together. This dividing ridge has a capping of pebbles and sand 25-30 feet or more in thickness, belonging to the Stratified Drift.

These beds can be traced along the Watermelon, Crabb, and Cheatham roads beyond Wyndham Springs on into Fayette county.

The pebbles are more abundant south of Wyndham Springs. North of that point sand beds prevail, and most of the higher hills are strewn with fragments of ferruginous sandstone near their summits.

Near the sources of Turkey Creek, in S. 9, T. 19, R. 9, W., a coal seam in two benches separated by shale. The per bench shaly, of no value, about 10 inches thick; the ver, 20–22 inches thick and of very good quality; it has en used in the forges of the vicinity.

In S. 28, T. 18, R. 9, W., a coal seam is exposed on a anch which crosses the Winton Dunn Road. The coal is out 10 inches thick and lies underneath a bed of shales.

The water of the Wyndham Springs, (NE ¼ of S. 8, T. 18, 9, W.,) is a pleasant sulphur water, which has its source obably in pyritous shales of the Coal-Measures. The rings are in a slight depression, surrounded by low hills med of sandstones. The surroundings are pleasant, and s ought to be a favorite summer resort. For those who efer chalybeate water, a fine cold spring of this character at a convenient distance from Wyndham Springs, at Mr. Hagler's.

A seam of coal, thickness not known, is exposed in the ter courses near Wyndham's. This coal has been worked a small scale to supply the forges.

Beyond the Springs the Cheatham road follows nearly the ter shed between North River and the Warrior, to the yette County line.

Upon this dividing ridge few rocks are seen, except the nd beds, with occasionally small beds of pebbles of the ift formation. The timber is red, white, post, Spanish and estnut oaks, a few short-leaf pines, some hickory and chest-t, black gum and tulip tree (poplar). This growth would licate a good soil—and such it is, so far as fertility is con-rned, but the slight depth of the shales below the surface nders the soil quite liable to suffer from drouth.

The thickness of the Stratified Drift beds over the Coal-easures diminishes gradually as we go northward, though casionally very heavy beds of white sand are encountered. e pebbles near the northern limit of the county are not merous and are quite small as compared with those seen arer the Warrior.

CHAPTER V.

WALKER COUNTY.

TOPOGRAPHY.

In the northwestern corner of this county there is ridge capped with gravel and sand. This ridge is a shed throughout its entire length in Winston, W Fayette, and Tuscaloosa counties. From its positi Walker county, and from its general trend in this and counties, from northeast to southwest, it will be seen th the streams of Walker county flow southeast and empty the Warrior or its tributaries.

Near the dividing ridge just spoken of, the land is and not very much broken, but nearer the mouths o various creeks which flow into the Warrior, denudatio produced an extremely rugged country, with high steep and deep ravines between. The Sipsey Fork and Mul river come together to form the Big Warrior and that the Little Warrior or Locust Fork, forms the main Between the Mulberry Fork or Big Warrior and the Lo Fork, or Little Warrior, there is a dividing ridge or shed, which makes the southeastern boundary of the co This is a true ridge of elevation, and is the prolongati the anticlinal fold of Brown's valley. It diminishes in h very gradually in going southwestward from Reid's g Blount county, where it is some 450 feet elevated abov water level in the Mulberry river at Hanby's mill. I lower (southwestern) portion of the ridge, the height is 200 or 250 feet above the level of the river, and this i general height of the hills on the western side of the Besides the Sipsey, the principal creeks of the county Blackwater, Cane, Lost, and Wolf creeks.


33
34
35
U N T Y
WEST THROUG
EXPLANATION OF COLORS
Stratified Drift or Orange Sand
Coal Measures
J.Bien, Lith. N.Y.

Geological Formations.

The geological formations found in this county are, 1st: e *Coal-Measures*; and 2d, The *Stratified Drift*. The intry is, in general terms, made by the rocks of the Coal-asures, which have in a few places, especially in the rthwestern part of the county, a capping of pebbles, ıds, &c., belonging to the Stratified Drift Formation.

Kinds of Rocks.

Coal Measures.—Conglomerates, sandstones, shales, and ıl beds, make up the Coal-Measure here as elsewhere. e sandstones are usually micaceous and of many varieties respect of their hardness and liability to decompose under the influence of the weather. In some localities the sand-ne is hard and compact, and lies near the surface over nsiderable areas. Occasionally it forms the surface un-vered by any soil, making what are called "rocky plains." Where the shales form the surface, the resulting soil is a y of varying stiffness. Occasionally the mingling of sands the Drift with the soil resulting from the disintegration of the shales, forms a soil which, in good seasons, is productive, t, where the shales lie near the surface, liable to suffer m drouth.

The coal being the softest and most easily worn of the cks of the Coal-Measures, is usually found along the beds branches and creeks, and commonly covered with dèbris, t now and then a bed of coal may be exposed in bluffs or rtical sections. One of the most striking of this class of posures is that of the Townley bed, where several feet of al are shown in the bluff of a small branch.

Stratified Drift.—The materials which make up this forma-n are sands, clays, rounded pebbles of quartz and fossilif-ous chert, ferruginous sandstone formed by the cementing gether of sand grains with hydrated ferric oxide, and con-merates formed of pebbles held together by the same ment. The stratification is extremely irregular, scarcely y where persisting in horizontal beds for any considerable stance. Strings of pebbles are sometimes seen imbedded

in reddish sandy clays, but usually the pebbles are found in tolerably thick beds, the lines of stratification of which are, however, very irregular. Most of the drift materials are highly colored, red, orange, and yellow with hydrated ferric oxide.

The Drift sometimes mingles with the soils formed from underlying rocks; but it is often found in beds of great thickness in this part of the country, usually covering the hill tops; the present heights of many of the hills in the northwestern corner of Walker county, are owing to a protecting cap of ferruginous Drift sandstone which has resisted denudation.

DETAILS.

1. *Coal-Measures.*—The dividing ridge between Walker and Jefferson counties and between the Mulberry and Locust Forks of the Warrior is, as has been already stated, the continuation of the Brown's valley anticlinal. From Reid's gap, which is the southwestern end of the *denuded* portion of the great anticlinal, the fold *(unbroken)* continues southwestward with gradually diminishing height till it sinks to the general level of the country near the confluence of the two forks of the Warrior.

From these circumstances it will be seen that along part at least of this ridge, the (geologically) oldest rocks of Walker county are to be found as surface rocks. From the crest of the fold towards Reid's gap, most of the softer sandstones and shales of the Coal-Measures have been removed by denudation, leaving exposed the hard quartzose sandstones which are generally found near the base of the Coal-Measures. The lowest of these rocks has often received the name of the Millstone grit, and it may be seen in the *broken* fold on each side of the valley at Reid's gap, and upon the *unbroken* part just southwest of Reid's gap, from which point it may be traced as a surface rock some miles southwestward. Standing upon this ridge near Reid's gap, one can see plainly the two coal basins, one towards the northwest drained by the Mulberry, the other southeast, drained by the Locust fork of the Warrior.

From this ridge the strata sink away rapidly on each side, d within three or four miles of its crest, the coal beds of e overlying strata are exposed in the rivers and along the nks of the other streams.

As yet, sufficient data are not at hand to enable me to give en an approximately full and accurate description of the pal-Measures in Walker county, and I can only speak of e outcrops of coal where they have been observed, and ve the thickness of the beds where it is possible. In those aces where coal has been worked a few years, or perhaps ly a few months ago, the exposures have been hidden by e washings of sand, &c., over them, so that only in the west instances has it been possible to measure actually the al beds. Generally I can give only the reported thick- ess.

On the road from Tuscaloosa to Jasper, near the north- est corner of T. 16, R. 9, W., outcroppings of coal may be en in the bed of Wolf creek and along the little branches owing into it. The thickness of the bed could not be meas- red. At this point the bottom of Wolf creek is about one ile wide and quite fertile. The main objection to it for ag- cultural purposes, is its liability to be overflowed every ear. There is a descent of about 400 feet from the sur- unding hills into the creek bottom.

Across Cane creek, coal is again seen about 75-100 feet bove the level of the creek.

Between Cane and Lost creeks an occasional small patch f pebbles of the Drift is seen, and pebbles also occur along ne immediate banks of Lost creek. Beyond this point owards Jasper, pebbles and sands are seldom seen.

Coal is reported as occurring in the bed of Lost creek, ear the crossing of this road. Its outcrop I did not see; ut about 150 feet above the water level is a coal bed, which neasures fifteen inches at its outcrop near the road. From his, however, no correct idea can be had of the actual hickness of the bed, since the outcrop was partially hidden n a mass of decomposing shales.

About four miles from Jasper another outcrop of coal was

noticed; height about 75 feet above Jasper, and in the edge of the town, a bed which is exposed in most of the branches in the vicinity. The thickness of this bed is something over one foot, but it was not possible to get a good exposure.

At several points near Jasper, there are springs breaking up through the carboniferous slates, the waters of which are slightly impregnated with sulphuretted hydrogen. Several springs of this sort occur about 2½ miles southwest of the town, and one is near the northern edge of the place. A fine chalybeate spring is upon the place of Mr. Stovall, in the town.

On the Jasper and Elyton road, near the crossing of Cane or Coal creek, are several outcroppings of good hard coal three feet in thickness.

At Davis' Ferry, coal, reported to be three feet thick, is reached at a depth of ten feet below the surface; coal is also found in the river close by, possibly the same bed.

Southeast of the ferry, an outcrop of coal is shown by the road near Section 17 or 18, T. 15, R. 5, W. Between Jasper and the river, near the 15 mile post, coal is seen at approximately the same level as the outcrop above given; but as the strata show occasionally decided undulations, one cannot say that the two outcrops are of the same bed of coal.

Near Davis' Ferry, the hills have a general elevation above the river level of 150 to 200 feet, and near the river the country is very much cut up by the water courses. In a few places, hills occur, 400 feet elevated above the river. Jasper, by aneroid observations, is about 100 feet above the river level at Davis' Ferry.

In the southeastern part of the county, near the line of Jefferson, and upon the flank of the dividing ridge above mentioned, are three small seams of coal, one of which has been worked to supply a local demand. These three seams have about the relation to each other as below given:

COAL, thin seam	6 to 8 in.
Sandstones, shales, &c	50 feet 0 "
COAL, thin seam	0 " 6 "
Sandstones, &c	30 " 0 "
COAL	1 " 0 "

From their position with regard to the anticlinal ridge, it probable that these are some of the lowest seams in alker county; yet the want of accurate surveys makes s merely an opinion.

On the Old Baltimore road, just at the crossing of Black-ter Creek, and near the mouth of the same, coal is seen the road, apparently the outcrop of a tolerably thick bed.

On the Jasper and Warrior Station road, the river is ossed at Sanders' Ferry, on the line between the northeast d northwest quarters of S. 26, T. 14, R. 6, W. At the outh of a branch just below the ferry, and near the water vel in the river, a bed of coal is known, of tolerably good ality and at least eighteen inches in thickness. Going up e hill to Mr. Sanders' house, another outcrop of coal is en.

Near the bend in the river, in the southwest corner of S. , T. 14, R. 5, W., is the old Phillips and Camak mine. At esent the pits are all filled with water and rubbish, so that coal exposure was seen. From 'Squire Phillips, who ised many boat-loads of the coal, and floated it down to obile, I have obtained the following notes concerning this ine: The bed averages 24–28 inches in thickness where ined; the coal was all taken from the bed of the creek out $\frac{1}{2}$–$\frac{3}{4}$ mile from the river; between the mine and the ver outcrops of coal may be seen all along the banks of the eek; the river must rise 15 or 20 feet before the water icks up into the mine; coal has also been raised from the d of the river, just below the mouth of the creek. From e above, it seems either that the coal bed dips northwest own the creek towards the river, or that there are several stinct benches of coal in the seam; and, from the fact that al has been raised from the bed of the river here, there is ry little doubt that there are at least two distinct beds, ithin a vertical distance of 25 or 30 feet.

Near the main road, some distance above the Phillips and amak bed, another coal seam is exposed, perhaps the same

as that mentioned as showing on the hill-side near Mr. Sanders'. Further on near Democrat, near S. 34, T. 14, R. W., coal shows again.

Old Town, or Old Warrior Town, is at the junction of the Sipsey and Mulberry forks of the Warrior, and, like most of the old Indian towns, is beautifully situated upon a bluff overlooking the country for several miles towards the north. On the north side, about one and a half miles from the river coal is reported as being abundant, probably the same seam as that worked at the Phillips and Camak mine.

Along the banks of the Mulberry, from the Gap at 'Squire Gravelee's, S. 34, T. 13, R. 5, W., for several miles eastward there is a bluff some 200 feet above the river bottom, and from one-half to one mile distant from the river. About 25 feet above the river level, there is a coal outcrop along the road. This bed has been worked in many places, and yields coal of very good quality.

This road, skirting the foot of sandstone cliffs some 200 feet in height, with the fertile bottom of the Mulberry to the south, affords many beautiful scenes.

A short distance from the Walker county line, in Blount county, near Arkadelphia, which is in the southwest corner of S. 16, T. 13, R. 4, W., several occurrences of coal are known, viz.: Three miles west of the town, some distance up the hill, a bed 2½–3 feet thick has been much worked, and the coal is considered good by the blacksmiths. This may be the same seam as that near 'Squire Gravelee's, although it is probably a higher one. About one mile east of Arkadelphia there is a thin seam 6–8 inches. From the bed of the river at Rutherford's ford, about S. 23, T. 13, R. 4, W. and about one and a half miles due northeast from Arkadelphia, large quantities of coal of superior quality have been raised. The thickness of this seam is not definitely known, but blocks of coal of one foot dimensions are common.

From these notes, we may infer that near Arkadelphia, in Blount, and the adjoining localities in Walker county, there are known at least three seams of coal, two of which are

rkable, and yield very good coal. If, as is probable, the
ım near 'Squire Gravelee's, and that near Arkadelphia,
distinct, there are three workable beds.

The sandstones in the vicinity of Jasper show false bedng—*e. g.*, north of the town where the road crosses the
ınch near Maj. Long's sulphur spring, the sandstone in
road appears, from this cause, to dip strongly southward
southeastward. The same false-bedded sandstones may
seen all down the branch to where the Jasper and Warr Station road crosses it, in the eastern part of town. In
ny places the false bedding has more the appearance of
ng regular stratification planes, and it is only where heavy
ls with cross lines of false bedding are superposed upon
h other that the true character of the inclined strata is
de apparent.

ıbout six miles north of Jasper, is the town of South
well, in the SW. corner of S. 15, and the SE. corner of
16, T. 13, R. 7, by aneroid observation 160 above Jasper.
country between is, for the greater part, a moderately
el pine woods. The Coal-Measures sandstones lie near
surface in part at least of this belt of long leaf pines.
rth of Lowell, on the Houston road, an elevation is
ched of 300 feet above Jasper. Mt. Zion church is upon
high land, which is a dividing ridge between Blackwater
Clear creeks. In the vicinity of Lowell several coal
nings are known, viz., in Rockbridge creek, one mile east
South Lowell, a bed, thickness not known; four miles
t of South Lowell, on Charlie creek, a bed, thickness
orted to be two feet; also in all this vicinity outcrops of
coal are numerous; this is in or near S. 13, T. 13,
3, W. Above the last named locality on Wilson's farm,
en miles west of South Lowell, a bed of excellent coal has
n worked, and the coal used in shops. It is highly
ised by the blacksmiths.

On the Jasper and Fayette C. H. road, about seven miles from the former place, and in the S. half of the SW. ¼, of S. 34, T. 13, R. 8, W., a bed of coal called the Townley bed is exposed in the bluff of a small branch. This is one of the thickest seams known in Walker county.

This bed was thoroughly examined and accurately measured, with the following result:

Section of Townley Coal Bed.

	Roof, yellowish slaty sandstones, with clay slate below.	
(3.)	COAL, bony above, consisting of layers of bony coal alternating with thin seams of hard, bright shining coal. The lower part (12 inches) of this coal is better, with less bony coal, and with thick partings of mineral charcoal	4 ft. 0 in.
	Hard clay slate with fossils	0 " 10 "
(2.)	COAL, good, hard and bright, free from slate and bony coal	2 " 0 "
(1.)	COAL, somewhat bony, but good, breaking into small cubes ½ to ¼ inch in size	1 " 3 "
	Black slate with fossil plants	

Into this hard slate bottom the cut was made about six inches. Coal from bed No. 2, is that which has been principally used by the blacksmiths of the vicinity, and it has a good reputation.

This bed is seen in several places in the vicinity, and has been worked on a small scale.

The exposure of this bed being in the bluff of a small branch, and being nearly all above water level, shows a rather imposing thickness of seven or eight feet in some places, thinning down however considerably within a short distance, and as the miners have only gotten out the coal of bed No. 2, without exploring below it, the most conflicting statements have been made concerning the bed.

Of the seven feet of coal only half, or perhaps less than half, would pay to mine; the clay slate parting separates the bed into two benches, of which the lower carries the best coal.

'he following analyses, by Mr. Henry McCalley, of coal m strata Nos. 1 and 2, and No. 3, of the above section, will w the character of the coal here exposed.

alysis of Coal from below the clay slate thickness three feet three inches. Locality, Townley bed, Walker county.

Specific Gravity	1.31
Sulphur	0.71
Moisture	3.007
Volatile matter	29.084
Fixed Carbon	63.352
Ash	4.557
	100.00

alysis of Coal from above the clay slate. Coal somewhat bony, with iron pyrites. Thickness, about four feet. Locality, Townley bed, Walker county.

Specific Gravity	1.45
Sulphur	1.744
Moisture	2.96
Volatile matter	26.162
Fixed Carbon	44.516
Ash	26.362
	100.000

From the analyses it will be seen that the upper bench is aly or bony, and inferior to the lower, which is a good al.

Further west, on the same road and about three miles from dridge P. O., is the Jaggers bed, which shows some points resemblance to the bed just described. It is seen along e banks and in the bed of Jagger's Creek, in Sections 11 d 12, T. 13, Range 10, West. The school house is near e best exposure: this is in the SW ¼ of the NW ¼ of S. 11. r about two miles down the branch from this point, the al may be seen. The bed, whilst apparently nearly hori- ntal as a whole, undulates very considerably, for just

above the school house the top of the coal is near the water level; a few rods below the school house, at one point, the entire thickness of the bed may be seen above the water, the bed of the branch being the underlying sandstone; from this point the coal sinks again down stream, so that a few yards from the ford only a foot or two of the upper part of the bed lies above the water, whilst the bed of the branch is a sheet of coal. At the point where the whole bed lies above water level, I made a careful measurement, with the following result:

Section of Jagger's Coal Bed.

Roof—Slaty sandstone, with fire clay below.

Very shaly coal, or rather a bituminous shale	0 feet	7 inches.
Shale, whitish on exposed surface.........	0 "	7 "
COAL, very bony.........................	0 "	10 "
COAL, very good, but still somewhat bony..	0 "	6 "
COAL, good, bright, with thick seams of mineral charcoal—some pyrites............	2 "	8 "
Bony Coal..............................	0 "	1-2 "

Sandstone bottom, forming here the bed of the branch, but soon sinking below the water level.

The bed has been examined by means of drills, by a company from Columbus, Mississippi, both above and below the point where the foregoing section was made, and the thickness reported to be about four feet.

Mr. Henry McCalley, in the Laboratory of the Survey, has analyzed two samples of coal from this bed. These analyses will show the general character of the shaly portions and of the better portions of the bed.

Analysis of Coal from Jagger's Bed, Walker county.

Coal consists of alternating layers, about one-eighth inch in thickness, of bright, hard, bony coal, breaking into cubes, and duller, softer coal. It contains also thin seams of mineral charcoal.

Specific Gravity..............................	1.44
Sulphur..	0.36

Moisture	2.238
Volatile matter	29.037
Fixed Carbon	50.638
Ash	17.987
	100.000

Analysis of Coal from Jagger's Bed.

A firm coal, smutting but little, breaking into cubes, and consting of alternating layers of bright, hard coal, and duller, fter coal, with an occasional thin seam of mineral charcoal.

Specific Gravity	1.233
Sulphur	.574

Moisture	3.091
Volatile matter	29.044
Fixed Carbon	56.537
Ash	11.328
	100.000

At the ford by the school house coal forms the bed of the anch, and this continues to be the case for half a mile wn to Mr. Brown's field, where the underlying sandstone ses to the surface. The sandstone comes to the surface ain at another ford two miles below, the coal showing along e banks, at intervals between these two points. By this it ll be seen that the rocks are undulating and the coal rises ove the water level, or sinks below it two or three times tween its upper and lower outcrops. Below the lower ford, gins a tolerably rapid fall, which continues down to the nfluence of Jaggers' with Mill Creek, in southwest corner S. 6, T. 13, R. 9, W. The difference in level between the al at the lower ford, and the waters of Mill Creek, is about feet, and the distance, following the windings of the creek, out one mile. Near the mouth of Jaggers' Creek the vine widens out considerably, the high bluffs of sandstone the two sides being several hundred yards apart. The d of Jaggers' Creek or branch is filled with huge blocks sandstone which have rolled down from the sides. In

some places the rocks form overhanging ledges of great size; one, which was examined particularly, has a height of 30 feet or more from the under side of the overhanging rock down to the floor, and the depth of the partial cave thus formed, was about 25 feet. Such places are called "Rock Houses," and they are certainly of great interest to a botanist, for againgt the damp, cool faces of the rocks, grow many varieties of beautiful ferns, and some rare ones, such as Asplenium montanum, Asplenium pinnatifidum, Trichomanes radicans, and Trichomanes Petersii. Besides the ferns, green masses of liverworts cover those parts of the rocks which are constantly kept moist by the dripping of water from overhead.

In the bed of Mill Creek, just below the confluence of Jaggers' branch, is a bed of coal which has been worked. By barometric measurement, the vertical distance between this and the Jaggers' coal bed, can not be less than 60 feet.

Jaggers' branch was closely examined to ascertain whether any other coal bed could be found between the Jaggers' and that in the bed of Mill Creek, but with negative results. Farmers living in the vicinity could give me no information concerning any such coal bed.

On the northeast side of Mill Creek, a small branch comes in just above the Jaggers' branch, and half a mile or more up that branch and above falls similar to those just described, coal is known, possibly the same bed that is exposed in Jaggers' branch. Also, north of the school house, coal is exposed in a branch. And in most places in adjoining sections 11, 12, 1, 2, 3, and 10, according to the testimony of the inhabitants, coal may be struck in wells in low places, at depths ranging from 10 to 15 feet, according to locality.

The country where the Jaggers' coal is exposed, is called "flatwoods," meaning merely open, level land, with no considerable elevations and depressions.

There is probably no coal bed in Alabama about which more exaggerated statements have been made, than about the Jaggers bed, and it may be worth while to consider the origin of such statements. It is probable that the undula-

ons in the bed, bringing it above and below the water level everal times in a distance of half a mile, have a good deal do with these misconceptions, for at one place the whole ed shows above the water, and not 20 feet from that point ne bed of the branch is a solid sheet of coal. If the rock rming the bed of the branch, where the coal was entirely bove the water, were not examined closely and found to be ndstone, it would be quite natural to infer that the thickess of the bed was much greater than it really is. It must e said that the exaggerated statements concerning the great ickness of the Jaggers coal bed were, without exception, eard at a distance from the place, and generally from perons who had either made a cursory examination or obtained eir information at second-hand. The farmers who live in e vicinity have a very correct knowledge of the true thickess of the bed, and from none of them did I hear it given more than four feet. The following named gentlemen ving near the coal bed, have placed me under obligations r favors rendered, and from none of these have I heard any aggerated estimate of the size of the coal seam: David alden, Thomas Herron, P. G. Tesney and Mr. Gullaher, the esent county treasurer of Walker county.

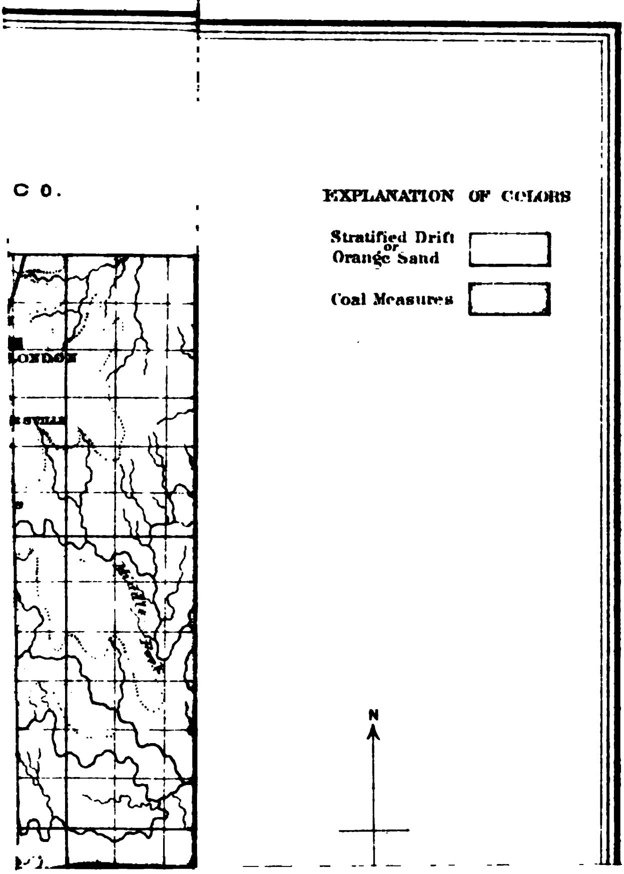
In Section 16, T. 13, Range 10, West, near Mr. P. G. Tesy's, and in Section 9, just north of him, a fine grained, aty sandstone is found, which has an extended local use as etstones. These stones occur of all grades of fineness, d they are very much valued wherever they have come into tice. The fragments lying exposed on the surface are nerally very hard and by no means so good as those which e freshly quarried. This peculiar rock occurs on the ridges mile or more from Mr. Tesney's.

Near the Byler Road, coal has been noticed near Kelly's ore, and further south, near the Masonic Lodge, in S. 19, 13, R. 10, W. By barometric observation, the coal at elly's Store lies some 50–60 feet above the Jaggers, whilst at at the Masonic Lodge is 175 feet above the same. ese measurements are, of course, liable to all the uncerinties attending aneroid barometric measurements.

2. *Stratified Drift.*—The Drift becomes important as a surface covering, only in the northwest corner of Walker county, in the vicinity of the Byler Ridge. East of this ridge the pebbles and sand beds become less and less abundant, and after several miles pebbles are rarely seen, whilst the sands may be noticed much further east. Along the Byler Ridge in this and other counties, both north and south, are many thick beds of pebbles alternating with sand.

Between the Jaggers coal bed and Eldridge P. O., pebbles cover most of the elevations, but the beds are not very thick.

The Masonic Lodge in S. 19, T. 13, Range 10, W., is situated upon a high hill of Drift beds. The elevation is some 225 feet above the Jaggers coal bed. This high point, like many others on the Byler road, is due to the protection afforded by a thin stratum of ferruginous sandstone, (sand grains held together by hydrated ferric oxide,) near the top. The Byler road follows, generally, this drift ridge; but, in places, it descends into the underlying Coal-Measures. Below Kelly's Store the old road, now thrown out, follows the ridge, whilst the new road leaves it, descending into the country drained by Box's Creek, &c., and comes upon the main water shed again in Fayette County, in the lower part of T. 14, R. 11, W.


C O.
LONDON
EXPLANATION OF COLORS
Stratified Drift
or
Orange Sand
Coal Measures
N

WINSTON COUNTY.

TOPOGRAPHY.

It will be seen by the map that the main dividing ridge between the waters of the Warrior and those of the Tombigbee, runs almost north and south the entire length of the connty, near its western line. This ridge—the Byler Ridge—in the northwestern part of Winston, also divides the waters of the Warior from those of the Tennessee, for Big Bear Creek, one of the tributaries of the Tennessee, has its source near this ridge.

The greater part of the drainage of the county, therefore, is southeast into the Warrior, the principal streams being the Blackwater Creek and the Sipsey fork of the Warrior, with its tributaries, Clear Creek, Brushy Fork, and Rock Creek.

On the western side of the Byler Ridge are the sources of the Buttahatchee and New river, which flow into the Tombigbee, and Big Bear Creek, a tributary of the Tennessee.

Although there are in this county no ridges except those formed by denudation, there is a gradual increase in the height of the land going northward from the Warrior river through Walker and Winston, into the southern part of Lawrence county, where the southern boundary of the Tennessee valley and the northern boundary of the Warrior field are formed by *Sand Mountain*. The general *fact* of such an increase in height may be seen by the subjoined figures, obtained by barometric observations from the Warrior river through Walker oounty into Winston.

It was impossible to get a more complete series of observations at the time of my visit.

With the Warrior River at Davis' Ferry as a datum, the following are the heights above that point:

Jasper	100 feet
South Lowell.*	260 "
Mount Zion Church	400 "

Beyond this there is a gradual elevation of the land, the crest of the mountain overlooking the Tennessee Valley in Lawrence county being the highest point. The basin shape of the entire Warrior field from this mountain on the north to the ridge which is the prolongation of the Brown's Valley anticlinal on the south, may be well made out when the country is seen from a height. The barometric readings above given, whilst they show the increase in height of land going northward, cannot, of course, be relied upon as giving the exact difference in level.

The face of the country throughout Winston county is generally much broken; the map will show the great number of small streams which rise in the northern and western part of the county, and which, by their confluence, form the three or four principal streams mentioned above. From the character of the rocks underlying the greater part of the county, viz.: sandstones and the frequent occurrence of deep ravines, with steep, sometimes precipitous sides, will be explained. The soils resulting from the disintegration of such rocks are never very fertile, and upon the ridges between the water courses, houses are not very common, the farming lands being usually down in the more fertile bottoms of the branches and creeks. Generally the principal growth upon the ridges is a mixture of post, white, red, and Spanish oaks, chestnut, sour gum, and, in some places, short leaf pines.

Wherever the sandstones lie near the surface, the so-called "rock houses" are formed, which are so numerous in this county. At the head of nearly every ravine may be found a crescent-shaped ledge of sandstone, with convex side up stream; the action of running water during rainy weather, and of the spring water flowing out from beneath the majority of these ledges, have the effect of washing out the softer slates and undermining the harder sandstone rocks. In this way, hollow crescent-shaped spaces are produced under a projecting sandstone ledge, and in the rock houses thus

formed, the walls of which are kept constantly moist from dripping water, flourish such ferns as Asplenium pinnatifidum, Aspl. montanum, Aspl. ruta-muraria, Trichomanes radicans, and Tr. Petersii. The last named species was discovered by Judge Thos. M. Peters, of Moulton, in the rock houses of some of the head waters of the Sipsey Fork of the Warrior.

The occurrence of these rock houses at the head of ravines in which there is no running water during the greater part of the year, is not uncommon, but springs of delightfully cold water, sometimes strongly impregnated with iron, issue from beneath most of these overhanging ledges.

The denudation caused by the waters of the creeks, gives to Winston county its reputation for wild and beautiful scenery. Many of the creeks have cut deep gorges in the hard sandstones and conglomerate of the Coal-Measures, and in some instances rapids and water falls have been formed. The most noted of these are the Clear Creek Falls, of which further description will be given below.

Geological Formations.

The formations represented in this county are the *Coal-Measures* and the *Stratified Drift*. The rocks here are like those of the same formations in the other counties above, and need no further description. In the general account of the Warrior Field, it was stated that the Plateau or Table land extended as far southwest as Winston county. The conglomerates and heavy-bedded sandstones which are near the base of the Coal-Measures, form the surface rocks over a good part of Winston county, as far west as the water shed between Sipsey and Clear Creeks.

The sandstones are sometimes uncovered by soil over considerable areas called "Rocky Plains." Through these rocks many of the streams have cut deep gorges, and especially is this the case in the southern and eastern part of the county. North and west, nearer the dividing ridge (Byler's), the face of the country is much less deeply marked by denudation.

From the above, it will be seen that the coal beds of the lower part of the series only are found in the eastern part of the county. These beds are not very many in number, and they are separated by many feet of barren rocks. Westward, beds higher in the series come in, and outcrops of coal become more numerous; but all the coal of Winston belongs, probably, near the base of the Coal-Measures.

The strata of the Coal-Measures in Winston have a general slight dip south and west.

DETAILS.

1. *Coal-Measures.*—Upon the Jasper and Houston road in S. 9, T. 12, R. 7, W., are the Clear Creek Falls. The waters of the creek here pour over two bluffs of conglomerate, some 200 to 300 yards apart, and each about 30 feet high. The heavy bedded sandstone and conglomerate which make the country here, are in many places underlaid with flaggy sandstones, which, being more easily removed, cause the formation of "table rocks," over which the water falls. These shelving rocks sometimes project as much as 10 to 15 feet. Between the two falls, on the right bank of the creek, it is almost impossible to descend to the water's edge, on account of precipitous bluffs; but, with some trouble, one may descend to the water below the lower fall.

These falls rival in beauty many which are annually visited by thousands of tourists. With the opening of this country to the world, by means of railroads, Clear Creek Falls will, without doubt, attract many visitors.

Near the channel of the creek, pebbles occur, possibly from the disintegration of the conglomerate.

In this part of the county, very few reports are heard concerning occurrences of coal.

Near the ford of Sipsey, the banks of the creek are perpendicular ledges of sandstone many feet in height, and at the heads of most of the ravines in the vicinity are "rock houses," such as have been mentioned above.

Houston, the county seat, is in the southwest of southeast of S. 27, T. 10, R. 7, W.

In the vicinity of Houston are some outcrops of coal, ich are mentioned below:

Two miles southwest of Houston, near Sipsey Creek.

Three miles east of Houston, on Brushy Fork.

Also, on Rock Creek, 7 miles east of Houston.

One-fourth of a mile northwest of the town, in a rocky rmation called "the Penitentiary," the coal occurs in thin ams, alternating with other rocks.

At the Ford of Brushy Fork, 4 miles east of Houston, is a in seam. Also at D. M. Hughes', 12 miles southeast of wn, coal has been mined on a small scale, and the same ay be said of a seam of good coal occurring on the Sipsey, ve miles southwest of Houston.

North of Houston, the Moulton road follows generally a idge to the northern boundary of the county. The prevailng timber in this section is post, white, red, and Spanish aks, chestnuts, sour gums, and occasionally short leaf pines.

Fragments of ferruginous sandstone similar to that occurring in the Drift deposits, are frequent in this part of the county, particularly covering the hilltops.

Occasionally amongst these fragments, tolerably fair specimens of iron ore (limonite) may be found. The absence of Drift deposits in any considerable quantity here, makes it somewhat doubtful, whether or not the ferruginous rock belongs to that formation.

There is a prevailing belief amongst the inhabitants of the county that silver, lead, and copper are to be found in the Coal-Measures of Winston. The time-honored "Indian story" about mines of silver and lead, may be heard in every township. Fragments of galena or lead ore have frequently been picked up in the wilds of Winston, just as pieces of the same ore may be and often are found in all parts of the Gulf States, viz., as *loose pieces*. There is no *authenticated* account of any metalliferous vein in the county, nor are such veins to be looked for in Coal-Measures, of which the entire county is made up.

In the western part of the county along the Byler road the

height of the ridge diminishes going south, as may be seen by the following aneroid observations, which show, approximately at least, the heights above the R. R. at Courtland:

Littlesville	470 feet.
Near Mr. Farriss', S. 16, T. 12, R. 10, W	430 "
Near lower line of Winston, in S. 28, T. 12, R. 10, W, Walker county	255 "

Near this road on both sides of the ridge, coal outcrops are known to occur in very many places. I subjoin a few localities which can be given with accuracy.

Near Littlesville, or rather about 2½ miles from Stevenson's gap, a bed of coal has been worked.

On Tedford's creek one of the branches of Sipsey, near S. 8, T. 8, R. 9, W.

One mile southeast of Littlesville, a thin seam of slaty coal.

One or two miles west of Littlesville, coal—thickness not known.

Three miles north of Littlesville church, on Bear Creek, is the Joseph South coal bed, said to be between 2 and 3 feet thick.

Near the DeGrafenried old place, east of the Byler road is a thin seam, which has been worked to supply blacksmiths' forges.

South of Littlesville, and beyond the junction of the Columbus road, the Byler road leaves the main ridge, and is in some places nearly impassable. At the heads of ravines on both sides of the road are found as usual, "rock houses" in which grow the luxuriant ferns spoken of above.

Larissa Postoffice is situated upon a hill of sandstone nearly white in some places. The rock is completely decomposed to some depth, and the sand resulting from this decay, though only slightly coherent, shows plainly the lines of stratification, the false bedding, and other marks of the original sandstone. Similar light colored, incoherent sandstones, have been noticed also in several other localities.

At Mr. West's, S. 16, T. 11, R. 10, W, is a bed of coal two

feet thick; this bed is exposed in several places near his house.

Near Mr. Farriss', S. 16, T. 12, R. 10, W, is coal, thickness not known. Also three miles southwest of Farriss' along Coal Bed branch, and two and one-half miles southeast, coal has been raised in blocks over one foot in thickness.

Not far from Miller's Stand P. O., in S. 33, T. 9, R. 10, W, clay iron stone has been obtained in some quantity.

A specimen of this ore, which, if found in sufficient quantity, may be valuable, has been analyzed by Mr. McCalley.

Analysis of Clay Iron Stone from S. 33, T. 9, R. 10, W, Winston County.

Specific gravity	3.563
Hygroscopic Moisture	.967
Water in Combination	1.437
Siliceous Matter	5.209
Sesquioxide of Iron	7,918
Protoxide of Iron	42.082
Alumina	4.046
Oxide of Manganese	.186
Lime	2.418
Magnesia	3.486
Phosphoric Acid	.341
Sulphur	.317
Carbonic Anhydride	31.908
	100.315
Metallic Iron	35.000
Phosphorus	.149

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2. *Stratified Drift.*—Upon reaching the summit of the mountain at Stevenson's gap, coming from the Tennessee valley, sand and pebble beds of this formation are soon encountered. These beds are somewhat infrequent at first, but going southward they increase in number and thickness. The

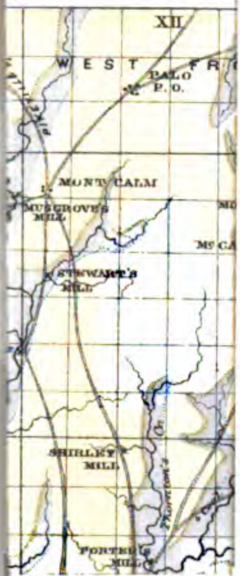
pebbles may be seen frequently overlying directly shales of the Coal-Measures, and in gullies good sections of pebbles, sand, and clay showing the irregular stratification which is characteristic of the Drift are not uncommon.

The pebbles are of quartz and rounded, though occasionally mingled with somewhat angular fragments of chert. In this respect, the pebbles differ from those found further west in Marion and Lamar Counties, where the angular chert pebbles are almost exclusively found.

The bed of pebbles which hides the line of junction of the Paleozoic and Cretaceous formations, has sometimes been considered a bed of Cretaceous age. The overlapping of these deposits, however, so far upon the Coal-Measures, as well as in the other direction, upon the lower Cretaceous beds, near Eutaw, and southward over still more recent beds, would point to a more modern age than Cretaceous.

South of the junction of the Columbus road, along what is known as the "Cut-off," pebbles are rarely seen, they come apparently not much further east than the main dividing ridge, for when the main ridge is reached again below the "Cut-off," pebbles are abundant, and they are found thence southward to the Walker county line and beyond, upon all the hill tops.

I O N C



EXPLANATION OF COLORS

Stratified Drift
or
Orange Sand

Coal Measures

CHAPTER VI.

WARRIOR BASIN—*Continued.*

Although the Coal-Measures of the three following counties, Fayette, Lamar, and Marion, are usually classed with those of the Warrior Basin, it will be seen by the maps that the drainage of a part only of this area, viz., the eastern half of Fayette is into that river, whilst the waters of the western half of Fayette, of all of Lamar, and of all but the northeastern corner of Marion, flow into the Tombigbee.

FAYETTE COUNTY.

TOPOGRAPHY.

A glance at the map will show two principal systems of drainage in this county, the one into the Warrior, the other into the Tombigbee. These are divided by a sinuous ridge which has a general north and south direction, and which is known as the Byler Ridge. Upon it for most of its length is an old thoroughfare, the Byler road, much used in former days.

The Warrior system may be still further divided, for a part of the water reaches the Warrior southeastward through Lost, Cane, and Wolf creeks; whilst a greater part goes south into the Warrior through North River and its tributaries. Cheatham's road runs nearly along this dividing line through part of the county.

The Tombigbee drainage is, in general, towards the south in three narrow belts not more than five or six miles wide east and west. The widest of these areas is that drained by New River or Sipsey; the next is drained by the Luxapolila,

and the third by Hell's Creek and Yellow Creek, both tributaries of the Luxapolila.

The ridges separating the areas are simple ridges of denudation. Going across the country from east to west, the roads pass over these ridges and the intervening valleys, whilst up and down the streams the roads are sometimes very good.

In general the dividing ridges vary in height from 200 to 275 feet above the streams.

Geological Formations.

Two formations are represented in this county, as in Walker county adjoining, viz., the *Coal-Measures* and the *Stratified Drift.* The surface formation over the whole county, except in the lower parts of the valleys excavated by the rivers and other streams, is the Drift, but beneath this superficial coat of sand and pebbles, may always be found at depths varying with the locality, the sandstones, shales and other strata of the Coal-Measures. A narrow strip five or six miles wide along the western border of the county shows no Coal-measures, for the reason that the streams have not cut entirely through the Drift covering into the underlying beds. In other words, the strata of the Coal-Measures slope away gently towards the west and south with a wedge-shaped mass of Drift, thin towards the east and thicker towards the west, overlying them. These relations are sufficiently well shown in the section at bottom of the map.

The varieties in the rocks have been given in some detail under Walker county, and need not be repeated here.

Details.

(1.) Coal-Measures.—In the following enumeration of localities where coal outcrops in this county, I have been obliged to rely upon information received from the inhabitants for the thickness of the seams, quality of the coal, &c. It has not been possible to make any actual examination of the coal beds for lack of the means to pay for having the seams exposed.

Fayette Court-House stands upon a bed of gravel and sand of Drift age, elevated some 75 feet above the second bottom of New River.

In the immediate vicinity of the town the Carboniferous rocks are hidden by the superficial beds spoken of above, and coal is found only near the banks of the rivers and other streams, and in deep wells.

About five miles southwest of the Court-House, on the Columbus road at the Abernathy place, coal is reported, and this seems to be the farthest west of any outcrop in the county. Two and one-half miles northwest of the town on the Renfro place, on the east side of Luxapolila coal is known. I could hear of no coal west of Luxapolila in this county. Along the Sipsey or New River are many exposures of coal, some of which I am able to give. On Davis' Creek, in T. 17 and R. 11, below Davis' Creek P. O. On Box's Creek, four or five miles south of east of Fayette Court-House. About six miles from the Court-House, on the Porter place, in the SE. $\frac{1}{4}$ of S. 10, T. 15, R. 12, W, a bed of coal is overlaid by a stratum of bituminous shale, usually called "cannel" coal, eight or ten inches thick. This substance has a peculiar resinous lustre, and upon analysis shows the following composition in 100 parts:

Analysis of Bituminous Shale, from Porter's place, Fayette County, by Henry McCalley.

SPECIFIC GRAVITY	1.099
Sulphur	1.501
Moisture	.286
Volatile Combustible Matter	75.688
Fixed Carbon	7.284
Ash	16.742
	100.000

This substance, which has the local name of cannel coal, is remarkable for its large per centage of bituminous matter. It burns freely with a bright smoky flame.

Upon distillation, it might yield valuable products, such as benzole, &c.

A few miles north of this point, near Jephtha Hollingsworth's place, a coal outcrop may be seen in the road. This bed has been worked. Also four miles from Jacob Hollingsworth's bridge, is a coal bed which has been much worked to supply coal to blacksmiths. Of its thickness I can give no notes. In the same locality is a quarry from which sandstone, splitting into smooth regular slabs, has been obtained in considerable quantity for building purposes.

Along Box's Creek, in T. 14, R. 11, W., are many outcrops of coal; at several of these, the coal has been worked; thus, in the SW ¼ of S. 15, in S. 11, and in S. 23. The thickness of the beds, I can not give with certainty, but the average will be about two feet.

In the SE corner of S. 24, same township and range, a stratum of bituminous shale (called here cannel-coal,) similar to that mentioned above, overlies a bed of ordinary bituminous coal.

Box's Creek bottom has some of the best farming land in the county. The bottom is nearly one mile wide. The soil seems best adapted to corn, for the cotton usually has too rank a growth and the bolls do not open well, many of the squares and forms drop off quite early.

Near the mouth of Moore's Creek, about S. 7, T. 14, R. 11, W., a ten inch seam of coal is exposed in the bluff of New River, and 15 or 20 feet below the ten inch seam, another two feet thick is found in the bed of the river. Along this creek and on New River, within a radius of 10 miles from Mr. Woodward Moore's, S. 12, T. 11, R. 12, W., are numerous outcrops of coal besides those mentioned.

Mr. Ira Woodward Moore, President of the Alabama Sipsey River Navigation Company, has for some years been interested in a scheme for carrying coal by barges down the river to Mobile. The coal is mined near the southern line of Marion county, and during the high waters of the winter the loaded barges are floated down the river to Mobile, where it can be delivered at $2 per ton. The locality of the mine

and other details concerning the coal, will be given under Marion county.

Along North River and its tributaries, coal is abundant, but I can give now no definite localities.

From the few notes thus given, it will be seen that outcrops of coal are found along all the principal streams of the county, and their tributaries. As to the number of workable seams of coal and their thickness, there is as yet no reliable information. To examine thoroughly one of these counties, and to determine definitely its capabilities for the production of coal, would take months of time and a considerable outlay of money. With the present small appropriation for the survey, the last named item, viz: an outlay of money, is an impossibility.

(2.) *Stratified Drift.*—The beds of this age are of the usual character, rounded pebbles, sand beds, clays (usually colored deep red or orange, by the hydrated oxide of iron), and ferruginous sandstones and conglomerates with the same hydrated ferric oxide as the cementing principle.

Distribution.—The Byler Ridge, which separates the waters of the Warrior from those of the Tombigbee, is near the eastern limit of the pebbles, for beyond that towards Walker county the beds of Drift, which are found sparingly on the higher points, are usually of sand only, or occasionally of small pebbles intermingled with the sands.

The pebbles are usually rounded quartz and chert fragments; the latter show often traces of organisms, usually impressions of crinoidal stems, &c., of Sub-Carboniferous age.

The beds of pebbles, whilst they cease to be a prominent feature of the surface geology of the county east of the Byler Ridge, are found in occasional patches, at least as far eastward as the ridge between Cane and Lost Creeks in Walker county, in T. 15, R. 8, W.

Along the Cheatham road in T. 16, R. 9, W., near Boley Springs P. O., the ridge is covered with beds of sand, with occasionally beds of small pebbles. The thickness of these

beds is considerable, as may be seen in the excavations near the saw mill and tan yard.

Along the Byler road every hill of moderate height is made up, in part at least, of pebbles, and most of them are capped with ferruginous sandstones or conglomerates. Near the Dublin P. O. the hills are covered with fragments of this sandstone, and in the road may be observed hollow pipes or cylinders of this substance lying in a northeast and southwest direction.

South of Mr. William Killingsworth's, S. 14, T. 14, R. 11, W. the hills as usual are capped with pebbles and ferruginous sandstone. The ferruginous rocks seem always to be encountered whenever the hills are as much as 200 feet elevated above the water courses. In T. 15, R. 11, W., the hollow cylinders of ferruginous sandstone lying in a northeast and southwest direction, may be seen again. In fact, wherever I have noticed these elongated forms of the Drift ferruginous sandstone, their longest dimensions point in this direction.

Between the Byler Road and Sipsey or New River, the pebbles are sometimes less abundant, but ferruginous sandstones and conglomerates are found upon every prominent hill. On the left bank of Sipsey, east of Fayette Court House, this conglomerate is found in beds of considerable thickness, making tolerably high bluffs.

The high bluffs which overlook the river on the eastern side, near Ford's bridge, in S. 11, T. 15, R. 12, W., have a capping of this rock many feet in thickness, and the road at the foot of this mountain passes many large fragments which have rolled down from the heights above.

Near New River, on both sides, pebbles are particularly abundant. The road from Fayette Court House up the right bank of the river, is for many miles over beds of this kind, and the road is of the very best character, smooth, hard and moderately level.

In some localities these pebble beds appear to be of exceptional thickness, as near Hollingsworth Mill, New River P. O, McCollom's Mill, &c.

Along the Pikeville road, on the western side of the ridge, between New River and Luxapolila, many of the pebbles are of chert, more or less angular and with impressions of Sub-Carboniferous fossils.

In many places among the Drift beds, are found strings of quartz crystals covering what have the appearance of being fragments of petrified wood; such are found, for instance, seven or eight miles north of the Court House, and two miles west of the town on Judge Williams' farm. At the latter place occurs, also, a peculiar modification of the ferruginous rock which characterizes the Drift. This rock is porous, from the occurrence within it of numerous lenticular or almond shaped concretions of limonite, hollow and enclosing a mass of white micaceous clay or sand. The shells of limonite are generally one or two tenths of an inch in thickness, in some instances double, the two being easily separated from each other. Occasionally the concretionary shells seem to be rather of the composition of turgite than limonite, as shown by the reddish color of the powder. The rock, when first quarried, is soft and easily cut with an axe, but after short exposure to the atmosphere it becomes quite hard and is said to be durable. It is used for rough stone work, in the construction of chimneys, pillars, &c. In this locality the rock is rather of the nature of a bog formation than of the usual ferruginous sandstone of the Drift.

Between the Court House and Luxapolila River, all the hills show a covering of pebbles, and the highest always a capping ferruginous sandstone. West of Luxapolila, on the road to Vernon, pebbles are noticed on all the hills whenever the elevation of 150–175 feet above the water courses is reached; below that elevation the strata are mostly sands and clays; the tops of the highest hills are always covered with fragments of ferruginous sandstone, or ferruginous conglomerate. The formation of these rocks appears to have taken place in this way: the sands, pebbles, &c., of the Drift, strongly colored with hydrated ferric oxide, in contact with atmospheric water, holding carbonic acid and organic matter, are leached of the iron, which in solution penetrates the

more porous strata, and upon reaching an impervious bed, say of clay or similar material, is arrested in its downward progress, gradually indurates from the evaporation or escape of the solvent, and in indurating binds together the sands or pebbles in contact with it. The formation, in this way, of hard ledges in recent railroad cuts, may be noticed frequently wherever the cuts are through beds of Drift sands, &c. The almost universal occurrence of fragments of these rocks upon the highest hills, may easily be explained. The hills of this part of the State are exclusively hills of denudation. After the Drift beds were deposited, there is reason for believing that the general face of the country was much more uniform than it now is. The effect of running water has been to cut up this more or less level country into gullies, ravines and gorges; to widen them out into valleys, leaving between as hills the portions of the original beds which were not so washed down. If any part of the originally nearly level country were soft and easily eroded, there would be formed a depression, which would in time become a valley of greater or less extent according to the amount of water passing over it. If a hard bed of any sort were formed, such as a bed of the ferruginous sandstone produced in the manner indicated above, it would protect the underlying beds of sands, pebbles, or other softer materials, from denudation, and would thus become the cause of the formation of a hill. The gradual undermining of the hard stratum, would cause it to break off, and in this way the sides of the hills for some distance below the protecting bed would be covered with its fragments. Every one familiar with our Drift regions, has noticed these fragments of ferruginous sandstone and conglomerate upon the sides of the hills which owe their existence, or at least their present height, to a protecting cap of this rock.

If the solution of iron formed as above described, from the iron which is diffused as coloring matter through the sands, instead of penetrating the strata and forming a hard-pan by induration, should come to the surface at a lower level, it would appear as a chalybeate spring. The conditions for

such springs are simple; atmospheric waters charged with carbonic acid, and holding organic matter, (by which the peroxide of iron is reduced,) dissolve the iron, penetrate the soil, and come to the surface again at some lower level. In contact with the air the carbonic acid escapes, the iron is changed back into the peroxide, which in the form of a hydrate is precipitated in the spring, or the outlet from the spring, as a flocculent mass of yellowish or reddish color. Several springs of this character are found within a few miles of Fayette Court House.

LAMAR COUNTY.

It is convenient to describe this county in connection with the Warrior Basin, although the Tombigbee, instead of the Warrior, receives its entire drainage.

No Coal-Measures have, so far as known, been observed in Lamar, yet it is probable that in the northwestern part of the county, near Pikeville, rocks of this age are exposed in ravines.

Whether exposed or hidden, there is no doubt that the Coal-Measures underlie the beds of Stratified Drift in that corner of the county, thus connecting Lamar with the great Warrior system.

The general course of all the streams of this county is southwest, and this determines, to a great extent, the configuration of the county. The principal streams are Luxapolila River, in the southern part of the county, Yellow Creek and Hell's Creek and other tributaries; and, in the northwest, Buttahatchee River and Beaver Creek and other tributaries. In the latitude of Vernon, which is situated in S. 16, T. 15, R. 15, W., the hills separating the streams are usually from two hundred to two hundred and fifty feet elevated above these water courses.

The only formation which has come under notice in the limited portion of the county visited, is the *Stratified Drift*. Beds of sand, clay, pebbles, and the rocks formed by the cementing together of the sands and pebbles by hydrated oxide of iron, form the surface covering.

The beds of Drift materials are very heavy, being in the middle and eastern part of the county, at least two hundred and fifty feet in thickness. From Vernon northwards towards Pikeville the pebbles are more or less angular, and of chert usually containing the impressions of Sub-Carbonifer-

ous fossils. With these are also found rounded pebbles of quartz of the usual character.

Between Fayette Court House and Vernon the road passes over all the hills separating the Luxapolila and the several prongs of Hell's Creek. These hills are often two hundred and fifty feet elevated above the water courses, and the upper fifty or seventy-five feet are formed of pebbles and sand; the highest hills being, as usual, covered with fragments of ferruginous sandstone.

Two miles west of Vernon are the ore banks which supplied the blast furnace of Messrs. Hale & Murdock. The ore banks resemble those of the Silurian formation in Middle Alabama, and those of the Sub-Carboniferous formation of Franklin and other counties in North Alabama. A deep red-colored soil holds masses of ore from the size of a bushel measure down to small pebbles. The ore is in concretionary masses like the ore of the two formations mentioned. The ore banks are in hills of moderate size, and are found over territory of considerable extent. In one place, where a gully has formed a natural section, the ore is seen to overly beds of pebbles. The source of the iron in this case is probably the same as that from which is derived the iron disseminated through the sands, &c., of the Drift as coloring matter, viz.: the cherty limestones of the Sub-Carboniferous formation further north. The nearest point where this limestone is known *in outcrop*, is forty miles distant from this ore deposit. It is quite possible, however, that future examinations may show that the limestone exists nearer to the ore hidden by the overlying Drift beds.

Mr. Henry McCalley, in the Laboratory of the Survey, has analyzed three samples of the ore from these banks. The analyses will show the character of the ore:

1. *Analysis of Limonite; an aggregate of nodules; the nodules compact and dark brown in color, held together by red and yellow ochre, with a few empty cavities, both within and between them. Streak, yellowish brown. Locality, site of the old "Hale & Murdock Iron Works," near Vernon, Lamar county.*

Specific gravity	3.421
Hygroscopic Moisture	1.777
Combined Water	12.465
Siliceous Matter	4.371
Sesquioxide of Iron	78.284
Alumina	0.760
Oxide of Manganese	.061
Lime	0.809
Magnesia	0.391
Phosphoric Acid	0.615
Sulphur	0.129
Undetermined and Loss	0.385
	100.000
Metallic Iron	54.80
Phosphorus	0.268

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2. *Analysis of concretionary limonite of uniform texture. Color, dark brown, with spots of red and yellow ochre filling some of the small cavities. Streak, reddish brown. Locality, near Vernon, Lamar county.*

Specific gravity	3.462
Hygroscopic Moisture	1.465
Water in Combination	12.372
Siliceous Matter	4.365
Sesquioxide of Iron	80.053
Alumina	.221
Oxide of Manganese	.188
Lime	.467
Magnesia	.045
Phosphoric Acid	.624

Sulphur	.085
Undetermined and Loss	.170
	100.000
Metallic Iron	56.037
Phosphorus	.272

3. *Analysis of compact limonite, with few irregular cavities; some of the cavities filled with red ochre. Color of fresh surface, dark brown, with the red ochre in spots. Exterior surface, brown, with a slightlg reddish tinge. Streak, reddish brown. Locality, near Vernon, Lamar county.*

Specific gravity	3.392
Hygroscopic Moisture	3.843
Combined Water	8.155
Siliceous Matter	4.506
Sesquioxide of Iron	81.173
Alumina	1.341
Oxide of Manganese	0.073
Lime	0.298
Magnesia	0.032
Phosphoric Acid	0.268
Sulphur	0.138
Undetermined and Loss	0.173
	100.00
Metallic Iron	56.821
Phosphorus	0.117

Northward from Vernon, the road follows a ridge, which is 200 feet above Yellow Creek. Along this road the pebbles are angular fragments of Sub-Carboniferous chert, with many characteristic fossils. These angular pebbles, like the rounded ones, are common in the ferruginous conglomerates which take a prominent place amongst the rocks of the country.

The village of Moscow is 180 feet above Yellow Creek near Vernon. On the higher points along the road, sand and loam form the surface. The pebbles are not common above the elevation of 175 feet.

Just beyond Moscow, in a gully, is seen the following section through Drift strata:

Pebbles and loam surface	——
Yellow sand, reddish below	1 foot 6 in.
White plastic clay	0 " 8 "
Pebbles imbedded in sand	3 " 0 "
Yellow sand, reddish below	1 " 6 "
Yellowish and whitish plastic clay	0 " 8 "
Yellow sand	5 " 0 "
Pebbles imbedded in sand to bottom of gully	2 " 0 "

This section is instructive as illustrating the mode of formation of the common ferruginous sandstone, for just above the two strata of clay, the sands are changed into a reddish sandstone. The iron solution percolating the sands, upon reaching the impervious clay, is arrested, the iron precipitated as hydrated ferric oxide, which binds together the grains of sand, thus forming a moderately hard rock. Another notable circumstance in this section is the regularity in the stratification, the several beds enumerated being parallel, and clearly marked for a distance of fifty yards. Usually, the stratification of the Drift beds is exceedingly irregular.

Beyond Moscow the road is generally a ridge road. On many of the hills, but not on the highest, pebbles are abundant. These pebbles are of chert and angular, and many of them contain casts of Sub-Carboniferous fossils, and these, like the rounded quartz pebbles further south, are often found cemented together by the hydrated ferric oxide into a breccia. These pebble beds are often from ten to twenty feet in thickness.

The relations of the pebble beds to the other Drift strata may best be seen from the following notes: At Purnell's Mill, NE. corner of S. 14, T. 15, R. 15, W., on the north bank of Beaver Creek, as well as on the opposite side of the creek bottom, the low hills are made up of angular pebbles of

chert with Sub-Carboniferous fossils, and with these occasionally rounded, smooth, pebbles of quartz, jaspér, &c. This association of angular chert pebbles, with those of the harder quartz, perfectly rounded and smooth, would show apparently that the quartz pebbles have been brought from a greater distance than those of chert. I have noticed both kinds of pebbles in nearly all the pebbly hills in Lamar, Marion, and Franklin Counties.

Beyond this mill, the road gradually ascends to a ridge, the water shed between Beaver Creek and Buttahatchee River, the average height of which above the water courses is 175 to 180 feet. No pebbles are found at this elevation, but lower down, within 50 feet of Beaver Creek and other streams, they are abundant. Towards Pikeville the ridge upon which runs the Military road, increases in elevation, the town being by aneroid observations 250 to 300 feet elevated above the level of Yellow Creek at Vernon.

MARION COUNTY.

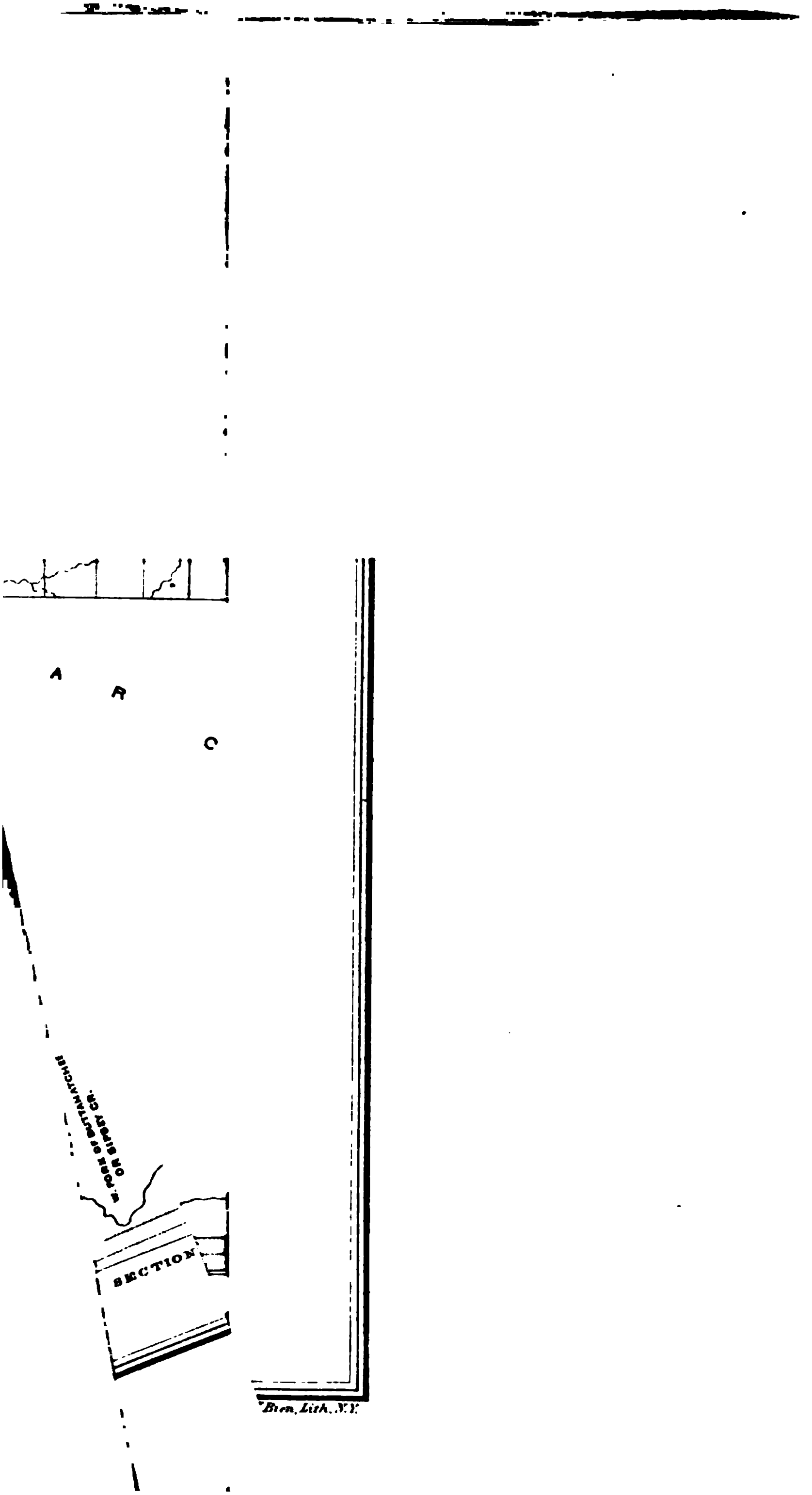
Topography.

An examination of the map will show that the drained by the Buttahatchee river and its tributaries cludes the greater part of the county. Subordinated to are the areas drained by New River and Luxapolila in southeast, by Bull Mountain creek in the northwest, and Big Bear creek in the northeast part of the county. head waters of Buttahatchee River flow from near the B ridge in Winston county. The general direction of stream is westward for eighteen or twenty miles, and southwestward into the Tombigbee. Most of the tributa of Buttahatchee flow southward into that river from the ridge of pebbles, etc., which turns Big Bear creek no wards. Bull Mountain creek also flows from the south of this ridge, whilst Big Bear creek, rising as it does near Byler Ridge, flows at first southwest, is deflected by the bly ridge spoken of, and is turned thence northwest into Tennessee. The bed of Big Bear creek is considerably higher than the head waters of Buttahatchee River, and Bull Mountain creek, which are distant from it only a few miles, so that a comparatively short canal cut through the ridge would suffice to turn the waters of Big Bear creek in a torrent into Buttahatchee or Bull Mountain creek.

New River and Luxapolila drain the southeastern part of county, New River having its head waters near the Byler Ridge, whilst the West fork of New River, and Luxapolila, rise at the foot of the ridge separating these from the tributaries of Buttahatchee.

Geological Formations.

In Marion County, we find as surface formations—1st, the *Coal-Measures*, and 2d, the *Stratified Drift.*


A R C
W. FORK OF BUTTAMATCHEE
OR SIPSEY CR.
SECTION
Bien, Lith. N.Y.

Over the entire county there is a superficial covering of pebbles and sand of the Drift age, these beds increasing in thickness from the Byler Ridge on the east, towards the west, where, beyond the Buttahatchee River, they are of such thickness that the streams seldom, if ever, cut through them down to the underlying Coal-Measures. In all the eastern and central portions of the county, however, nearly as far west as the line between Ranges 14 and 15, the streams have cut through these superficial beds, and laid bare the rocks of the Coal-Measures underneath.

Except in the northwestern part of the county the underlying Coal-Measures probably do not extend much further west than the line between Ranges 14 and 15, where there is reason for thinking they are succeeded by the rocks of the Cretaceous System. Still the line of junction of the two is hidden by the immense thickness of pebbles and sand, so that as yet it cannot be laid down with accuracy.

On Prof. Tuomey's map, the area beyond the western line of the Coal-Measures in Marion, is marked as Sub-Carboniferous, whilst according to Prof. Hilgard, of Mississippi, it should be Cretaceous. I have not succeeded in finding west of the Coal-Measures anything except the Drift, until after crossing Big Bear creek in the southwest part of Franklin County, where the Sub-Carboniferous rocks are exposed. For these reasons I have thought it best not to attempt at present to represent the underlying rocks west of the Coal-Measures, but simply to put it all down as Drift, which is actually the surface formation if not of the whole area, at least of all but a few isolated tracts along the banks of the streams. In future editions of the map it may be necessary to make a few slight changes.

DETAILS.

1. *Coal-Measures.*—The limits towards the west, of the Coal-Measures in Marion County have already been given above in the general description. The coal beds along the head waters of New River or Sipsey, and of Little River, a branch of the Sipsey, are perhaps better known than those of other parts of the county.

Above Kelly's Mill, on New River (S. 10, T. 13, R. 11, W., and about one and a half miles from the mill, is the locality from which most of the coal has been mined which has been boated down to Mobile by the Sipsey River Navigation Company. From Mr. Ira Woodward Moore, President of the Company, I have obtained most of the information below given. The bed is said to be 2 feet 6 inches thick. Above this bed, and separated from it by about five feet of strata, is another coal bed two feet thick. The lower bed only has been worked. This coal seems to be an excellent gas coal. Mr. Fish, of the Mobile Gas Works, in a letter to Mr. Moore, gives it much praise. Several miles west of this Mr. Moore mentions an outcrop of what he considers the same bed, on a branch running into Little River. Lower down the river, near the Fayette county line, coal said to be about two feet in thickness is known; it burns well, but is not a very good shop coal. Of the numerous localities where coal shows higher up on New River, I have no reliable information. Upon Little River, near S. 1, T. 12, R. 12, W., are many outcrops of coal.

At Mr. Lem Burnett's, NE. corner of S. 1, coal is raised from the bed of a branch, the thickness of the coal not ascertained. This coal is hard, firm, and bright, tolerably free from pyrites. It has through it seams of mineral charcoal often one-eighth to one-quarter of an inch in thickness. This coal has an excellent reputation amongst the blacksmiths, and it is hauled many miles.

An analysis of this coal made by Mr. Henry McCalley, at the Laboratory of the University, shows the following composition in 100 parts:

Specific Gravity	1.102
Sulphur	1.730
Moisture	3.694
Volatile Combustible Matters	35.380
Fixed Carbon	58.517
Ash	2.409
	100.00

The mineral charcoal, which is so characteristic of some of the coals of Walker, Fayette, and Marion Counties, is of interest.

A specimen of it from coal from Mr. Burnett's bed, upon analysis by Mr. McCalley, shows the following composition:

Specific Gravity	1.551
Moisture	1.753
Volatile Matter	15.285
Fixed Carbon	79.215
Ash	3.747
	100.000

Near Mr. Burnett's, and at a vertical distance of 25 feet above the coal bed just mentioned, is another outcrop in the bluff of a small branch. This outcrop is in the NW. of S. 1, on land belonging to Mr. Beauchamp. The roof is hard shale and floor of the same material; the bed is two feet thick at the outcrop, and, with the exception of an inch or two of slaty coal on top, is good throughout. This coal is also hard, firm and bright, with seams of mineral charcoal like the coal at Burnett's. At the outcrop it shows some pyrites.

In the same neighborhood, on Mr. Shirley's land, coal has been worked. It is like that of Burnett's, and has the best reputation as a shop coal.

At Mr. Hendon's, S. 36, T. 11, R. 12, W., in a well, a bed of coal 18 inches thick was cut at a depth of 8 feet below the surface; below this a clay parting, 18-24 inches thick, and then another bed of coal which was not cut through, the bottom of the well being in the coal. By aneroid observation the following distances have been made out between the coal beds in this vicinity:

Hendon's upper bed	18 inches.
Clay parting	24 "
Hendon's lower bed—thickness not known.	
Sandstones and other Measures (may contain coal)	85 to 90 feet.
Beauchamp's coal	24 inches.
Sandstones, &c.	25 feet.
Burnett's coal—thickness not known, but at least two feet.	

For several miles from Burnett's in almost any direction, coal outcroppings are numerous; amongst these may be mentioned one at Thompson's mine, two or three miles east of Burnett's; this mine is said to yield a good coal, rather harder than any yet mentioned above.

On Clifty Fork, a few miles west of Burnett, is a locality from which coal is hauled for many miles to supply blacksmiths. Accounts of the thickness of the coal on this branch vary. Some give it at two feet, others as much as four feet.

Mr. Purnell, on Beaver creek, who has hauled the coal from this branch to supply his shop, informs me that he has measured the bed and that it is two feet thick, but all good coal. It may be that other beds are exposed on Clifty Fork, the thickness of which may be greater than two feet; thus a bed near Mr. Stephen Vaughan's, S. 23, T. 12, R. 12, W., is reported as being more than three feet thick.

Of coal on Luxapolila River, in Marion county, I can give no localities, nor have I definite notes of any outcrops on Beaver Creek, though the coal is known on both streams.

On Buttahatchee River, three miles west of Pikeville, are reported at least two beds of coal; one six inches thick, and the other of workable size. The coal has been used in blacksmiths shops.

Three miles southwest of R. W. Terrel's, also a bed of coal has been worked on a small scale.

Of outcrops along Buttahatchee and its tributaries above Pikeville, I have no notes except that coal of good quality is known on Barren Creek.

On Big Bear creek and its tributaries, several outcrops are known.

At Allen's Factory, S. 17, T. 9, R. 11, W., the coal has been worked to some extent.

On Bull Mountain creek, near S. 3 or 4, T. 9, R. 14, W., is a bed of coal 18 inches thick, and another near this two feet or more in thickness.

On the same creek, five or six miles below Bull Mountain P. O., coal is said to occur, and this is as far west as I can hear of any outcrops.

On the Hurricane fork of Sipsey creek, or the West fork of Buttahatchee, (as it is also called,) as far down as S. 24, T. 9, R. 15, W., several small seams are reported.

Near Pikeville the sandstones of the Coal-Measures are seen in bluffs on all the little branches. On Raven's-Nest Branch, a mile or two north of Pikeville there are very high bluffs, and some overhanging cliffs or "rock houses." Underneath some of these cliffs grow the most beautiful ferns, such as Trichomanes radicans, Asplenium pinnatifidum, Asplenium montanum, &c. Clusters of the first named fern were noticed with some of the fronds six or eight inches in length.

In some places along this branch, very decided dip 3°-4°, a little west of south, may be observed.

Between Pikeville and the head waters of New River, the sandstones of the Coal-Measures are encountered in all the ravines which are 100 to 125 feet below the level of Pikeville, above that are the pebbles and sands of the Drift.

On the Military road, near the ford across Buttahatchee, the sandstones are exposed at a vertical distance of 275 feet below Pikeville; the ford 280 feet below the same place, is over smooth nearly level sandstones. The bottom of Buttahatchee on the northwest side is one-fourth of a mile wide, and where the road passes the sand is very deep.

Sandstones of the Coal-Measures are reported on Bull Mountain creek, six miles below the Post Office of that name.

2. *Stratified Drift.*—What has been said under Fayette, and especially under Lamar county, concerning the occurrence of the Drift, will apply equally well to Marion.

Near Beaver Creek, and at height of 50 to 75 feet above the level of the creek, the strata are chiefly pebbles; above that height are found reddish sands and clays, with numerous fragments of ferruginous sandstone. On the highest ridges sands prevail, with the dark ash colored soil common on all high black-jack ridges.

East of Pikeville, on the Moulton road, especially not upon the highest points, are numerous pebble beds; the pebbles are angular fragments of chert with casts of Sub-Carboniferous fossils. In the ravines where sandstones of the Coal-Measures are exposed, are pebbles of large size, rounded, and composed of quartz, jasper, etc., with some chert pebbles like those found upon the higher levels.

Thus, near Mr. Lem Burnett's there are such rounded quartz pebbles of large size, four to six inches in diameter occasionally, in the bottoms of the small streams. In S. 6, T. 12, R. 11, W., near the old Van Hoose place, a stream of these pebbles occurs, in which it seems to be established beyond doubt, that gold in small quantity has been found. This gold has, therefore, been transported a great distance, the nearest gold-bearing rocks in the direction from which the pebbles could have come being those of western North Carolina, the pebbles with the gold having probably been brought down the Tennessee valley, and thence southward through Marion and Fayette counties. A few miles north of Fayette Court House is another locality where well confirmed reports are heard of discoveries of gold in a stream of similar large pebbles of quartz, jasper, etc.

Near the corner of Sections 25, 26, 35 and 36, T. 11, R. 12, W., a mile or two from Mr. Burnett's, there is a hill rising some 100–150 feet above the surrounding country. The hill, called Blaylock's Mountain, is entirely made up of materials of Drift age. The mountain owes its present height to a capping of hard ferruginous conglomerate and sandstone, formed in the manner described under Fayette county. These rocks are of dark brownish color, relieved by the light yellow pebbles of chert and sometimes white pebbles of quartz. The conglomerate is hard and massive, showing no tendency to split in one direction more readily than another. From these rocks, especially from the conglomerates, millstones are made for all the surrounding country. Mr. Hendon, who works at the business, has usually more orders than he can fill.

Between Blaylock's Mountain and Pikeville, are several

localities where similar rocks occur, which are, in some instances, worked up into millstones.

A few miles west of Pikeville the same rocks are found. Specimens handed to me by Mr. West are almost identical with those from Blaylock's.

Between Pikeville and Bull Mountain Post Office, the road passes over Drift deposits, except near the ford of Buttahatchee, where the underlying Coal-Measures sandstones are exposed by denudation. At Bull Mountain Creek again, these underlying rocks are exposed. Between these two points the road traverses some high ground, 180 feet above Pikeville, or 450 or 460 feet above the Military ford across Buttahatchie. Beyond Toll-gate P. O. a hill of pebbles of Sub-Carboniferous Chert, 225 feet above the ford, is ascended, and the road continues for some distance along a ridge generally of this elevation. At Mr. J. W. Sanderson's, near the center of S. 22, T. 10, R. 14, W., a well forty feet deep has been dug through the pebbles and water found in the same. Many of the pebbles, which are of chert and somewhat angular, contain casts of Sub-Carboniferous fossils.

Beyond this point, along the New Cut Eastport Road, about 15 miles from Pikeville, the high ridge spoken of above is ascended. Along this ridge, or series of ridges, 180 feet above Pikeville, the road continues for seven miles, till the descent begins into the bottom of Bull Mountain Creek. Upon these high ridges no pebbles are found, nor rocks of any kind, except occasional fragments of ferruginous sandstone. The soil is the light ashy soil mentioned once before. Upon these higher ridges, also, another peculiarity may be observed, viz: the tops of the ridges are usually broad and gently undulating, with no sharp ascents and descents, showing the very slight effects produced by denudation upon this water-shed.

In the descent towards Bull Mountain Creek pebbles may be noticed within 50 feet of the level of the creek, and these continue the rest of the way down the hill. In the bottom of the creek quartz pebbles, well rounded and of large size, like those noticed near Burnett's, are abundant. Here, as

at several other places, pebbles occur of two different kinds. those of chert, and somewhat angular, found more abundantly upon the hills as high as 50–75 feet above the water courses; and large rounded pebbles of quartz, jasper and other similar material, near the beds of streams. With these last are often found, also, the usual chert pebbles mentioned above.

Below Big Bear Creek, *i. e.* towards the south and west, in this county and in Franklin county above, is a ridge of pebbles and other Drift material which has turned the waters of that creek into their present extraordinary course.

As has already been stated, the waters of Big Bear Creek run along a higher level than the streams south, so that a cut through this ridge of pebbles would turn the whole stream south, through Marion county.

Big Bear Creek at Burleson, in Franklin county, is some 75 to 100 feet above Bull Mountain Creek, near the postoffice of that name; but all these levels are given from aneroid observations, and, like all aneroid observations, are not entirely trustworthy; still there is very little doubt that the difference in level between the two points is considerable.

CHAPTER VII.

CHEMICAL REPORT BY HENRY McCALLEY.

Dr. E. A. Smith, State Geologist:

DEAR SIR—In accordance with your request, I herewith submit, in a condensed form, some of the methods of analysis, as made by me, and their results.

Yours, very truly,

HENRY McCALLEY.

University of Alabama.

COALS.

Proximate Analysis.—Constituents determined: Moisture, Volatile matter, Fixed Carbon, and Ash; and, also, the whole amount of Sulphur.

Moisture.—Determined by loss in weight after a well pulverized sample has been exposed for one hour, in an air bath, to a temperature of 110°C.

Volatile Matter.—Determined by heating the specimen, minus the moisture, in a covered platinum crucible, for four minutes at a red heat and then for four minutes more at a white heat. Loss in weight equal volatile matter.

Fixed Carbon.—Coal, less moisture and volatile matter, is incinerated in a platinum crucible placed aslant, with a piece of platinum foil so resting in its mouth as to reflect back otherwise wasted heat, and to create a current of air over the exposed coal. Loss in weight equal fixed carbon.

Ash.—Residue after incineration equal ash.

Sulphur.—Five parts each of dry, well powdered, carbonate of soda and nitrate of potash are intimately mixed, and then the finely pulverized coal is added, and the whole well mixed. This mixture is now thrown, by small portions, into a white hot platinum crucible with a closely fitting lid. The lid is quickly replaced, and time allowed, after each addition, for quiet fusion. When the whole mixture has thus been added, and time allowed for complete oxidation, the

crucible, with its contents, is allowed to cool. When cold, it is digested with water until complete disintegration; the crucible and lid can then be removed from the casserole. Strong hydrochloric acid is now cautiously added, to excess. This acid can be conveniently added through the beak of a funnel fitting with its rim within the casserole. After excess of acid has been added, it is evaporated to dryness over a water-bath. The dry mass is now digested with a few drops of strong hydrochloric acid. Hot water is now added and the insoluble residue, if any, is separated and washed by decantation and filtration. To the boiling filtrate is now added a slight excess of chloride of barium. The solution is kept hot for some time, when the precipitated sulphate is allowed to settle. The clear supernatant liquid is now decanted off, and the precipitate treated with very dilute hydrochloric acid; after which, it is well washed by decantation and filtration, dried, incinerated, and weighed. This sulphate of baryta, multiplied by .13734, gives the whole of the sulphur present in the coal.

Specific Gravity.—Determined by means of the specific-gravity bottle; the coal having been broken up into lumps of about the size of a pea.

The results of the coal analysis are now appended:

BITUMINOUS COALS.

Proximate Analyses, including Sulphur.

	1.	2.	3.	4.	5.	6.	7.	8.
Specific Gravity	1.31	1.45	1.44	1.233	1.102	1 551	1.33	1.278
Sulphur	.71 p'r ct.	1.744 p'r ct.	.36 p'r ct	.574 p'r ct.	1.730 p'r ct.	....	1.224 p'r ct	.612 p'r ct.
Moisture	3.007	2.96	2.238	3.091	3.694	1.753	1.474	1.529
Volatile Matter	29.084	26.162	29.037	29.044	35.380	15.285	32.288	30.683
Fixed Carbon	63.352	44.516	50.638	56.537	58.517	79.215	59.503	63 686
Ash	4.557	26.362	17.987	11.328	2.409	3.747	6.735	4.102
Totals	100.000	100.000	100.000	100.000	100 000	100 000	100.000	100.000

No. 1.—From below clay parting; coal firm and lustrous, smutting but little; seam about three feet in thickness. Locality, Townly bed, Walker county.

No. 2.—From above clay parting; a dull, heavy coal; a little shaly, with shining streaks of iron pyrites; seam about four feet in thickness. Locality, Townly bed, Walker county.

No. 3.—From bottom seam, consisting of alternate layers, about one-eighth inch in thickness, of bright, hard coal, breaking into cubes, and of duller, softer coal. It also contained three layers of mineral charcoal. Locality, Jagger bed, Walker county.

No. 4.—A firm coal, smutting but little, breaking into cubes, and consisting of alternate layers of bright, hard coal, and duller, softer coal, with an occasional thin layer of mineral charcoal. Locality, Jagger bed, Walker county.

No. 5.—Firm and almost free from smut, consisting of alternate layers of bright and duller coal, about one-fourth inch in thickness, with a layer of mineral charcoal of same thickness. Locality, Burnett's bed, Marion county.

No. 6.—Mineral charcoal, scraped from sample from Burnett's bed, Marion county.

No. 7.—An average sample, representing the vertical section of the upper bench. Locality, Pratt Coal & Coke Company's seam, near Birmingham, Jefferson county.

No. 8.—An average sample, representing the entire vertical section of the lower bench. Locality, Pratt Coal & Coke Company's mine, near Birmingham, Jefferson county.

Bituminous Shale.

Proximate Analysis—Method same as that of Coals.

Specific gravity	1.099
Sulphur	1.501 per cent

Moisture	.296
Volatile Matter	75.688
Fixed Carbon	7.284
Ash	16.742
	100.000

A little greasy to the touch, and, in splinters, burning with a very free, luminous, smoky flame, with a strong bituminous smell; color, a dark gray on a fresh surface, but, on weathering, becomes a dirty brown; vein said to be ten inches in thickness. Locality, six miles northwest of Fayette Court House, Fayette county.

SLATE, forming the parting, two inches in thickness, between the upper and lower benches of coal in the Pratt Coal & Coke Company's seam, near Birmingham, Jefferson county.

Proximate Analysis of Slate.

Specific gravity	1.988
Moisture	1.621
Volatile Matter	11.719
Fixed Carbon	23.839
Ash	62.821
	100.000

Ash of Slate.

Silicic Acid	63.155
Iron Sesquioxide	6.383
Alumina	22.884
Lime	.703
Magnesia	.536
Potash	2.164
Soda	1.143
Phosphoric Acid	2.564
Sulphuric Acid	.145
Sulphur Combined	.051
Chlorine	trace ......
	99.728

The silica, potash, soda, sulphuric acid, sulphur, and chlorine determined according to the method employed by the Geological Survey of Ohio, in report for 1870. The iron determined volumetrically; the phosphoric acid, as under iron ores; and the alumina, by difference, having been thrown down with the peroxide of iron and phosphoric acid, and dried, weighed, and incinerated with them.

IRON ORES.

Methods of Analysis.

Specific Gravity.—Determined by means of specific-gravity-bottle, the ore having been broken up into small lumps.

Hygroscopic Moisture.—An average sample of the finely pulverized ore is weighed and dried at 100°C. Loss in weight equals hygroscopic moisture.

Combined Water.—In case of the pure sesquioxide ores, determined by heating the specimen—minus the hygroscopic moisture—to redness for twenty minutes. Loss in weight equals combined water. In case of the carbonates, or ores containing the protoxide, water was determined by direct weighing. The specimen—minus the hygroscopic moisture—being heated for twenty minutes in the bulb of a hard glass tube, through which a current of dry air was constantly passed; the moisture was collected in a weighed chloride of calcium tube. Increase in weight of the chloride of calcium tube equals the combined water.

Silica, Iron, Alumina, Manganese, Lime, Magnesia, and Sulphur.—The specimen of ore—minus the hygroscopic and combined moisture—is well mixed with a mixture of four parts of carbonate of soda and two of nitrate of potash, and fused, as described above, under the determination of sulphur of the coals. The cooled mass is digested in water, acidified with diluted hydrochloric acid, until complete disintegration, and the crucible and lid can be removed. The solution is now cautiously treated with strong hydrochloric acid to excess, and evaporated to dryness over a water-bath. The dry mass is now digested with a few drops of strong hydrochloric acid, after which hot water is added. The insoluble silica is now separated and washed by decantation and filtration, dried, incinerated, and weighed. The filtrate is diluted to a known bulk, and divided into two parts, one of two-thirds and the other of the remaining third. From the two-third solution the iron is thrown down as sesquioxide with the alumina and phosphoric acid, while excluded from air. The alumina and iron are now separated

by means of hyposulphite of sodium. In the filtrate from the iron, alumina, and phosphoric acid, the manganese is determined as binoxide, by means of bromine. From the filtrate, after separation of manganese, the lime and magnesia are separated and determined after the usual methods. In case any of the protoxide of iron is present, it is determined, as such, by treating a well powdered sample of the ore with strong sulphuric acid, in a flask from which the air is expelled, diluting the solution, and, when perfectly cold, determining the protoxide volumetrically, by means of permanganate of potassium. The sesquioxide present in the ore, as such, can now, of course, be found by subtracting from the whole amount of iron, as found above, the protoxide, as just found. To the remaining one-third solution, heated to boiling, a slight excess of chloride of baryta is added, and the sulphur determined with the precautions stated under coal analyses.

Phosphoric Acid.—A finely pulverized sample of the ore is gently heated with strong hydrochloric acid until the residue looks white, when the solution is diluted and filtered. The filtrate is now treated with ammonia to excess, and then slightly acidified with nitric acid, when it is heated to boiling, and an excess of acid molybdate of ammonia added. The solution is kept near the boiling point as long as a precipitate continues to form. If a precipitate does not form immediately, a little more nitric acid is added, and the solution concentrated by evaporation. The phospho-molybdate of ammonia, thus obtained, is washed well with a dilute solution of acid molybdate of ammonia, dissolved with strong ammonia, and the phosphoric acid determined as pyrophosphate of magnesia.

Carbonic Acid.—Determined, in the usual way, by loss in weight of a suitable apparatus after the gas has been expelled.

The results of the iron ore analyses are now appended in a tabular form:

Iron Ores.

	1.	2.	3.	4.	5.	6.
Specific Gravity	3.421	3.392	3.461	3.616	3.800	3.562
Hygroscopic Moisture	1.777	3.843	1.468	1.648	.833	.967
Moisture in Combination	12.466	8.155	12.372	10.444	11.849	1.437
Siliceous Matter	4.371	4.506	4.367	3.159	2.864	5.209
Sesquioxide of Iron	78.284	81.173	80.053	84.696	83.514	7.918
Protoxide of Iron	00.000	00.000	00.000	00.000	00.000	42.082
Alumina	.760	1.341	.221	.220	.141	4.046
Oxide of Manganese	00.000	0.073	.188	.087	.188	.186
Lime	.809	.298	.407	.440	.407	2 418
Magnesia	.391	.032	.045	.025	.045	3.486
Phosphoric Acid	.615	.268	.624	.765	.760	.341
Sulphur	.129	.138	.085	.055	.085	.317
Carbonic Anhydride	00.000	00.000	00.000	00.000	00.000	31.908
Loss	.398	.173	.170	.. ...	......	......
	100.000	100.000	100.000	101.539	100.206	100.315
Metallic Iron	54.80	56.821	56.037	59.287	58.459	35.000
Phosphorus	.268	.117	.272	.334	.332	.149

No. 1.—Brown Hematite. An aggregated nodular mass; the nodules compact and dark brown in color, held together by red and yellow ochre, with a few empty cells both within and between them. Streak, yellowish brown. Locality, site of old "Hale and Murdock Iron Works," near Vernon, Lamar county.

No. 2.—A compact limonite, with a few irregular cavities. Some of the cavities filled with red ochre. Color of fresh surface, dark brown, with the red ochre in spots. Exterior surface, brown, with a slightly reddish tinge. Streak, reddisn brown. Locality, site of old "Hale and Murdock Iron Works," near Vernon, Lamar county.

No. 3.—A concretionary limonite of uniform texture. Color, dark brown, with spots of red and yellow ochre filling some of the small cavities. Streak, reddish brown. Locality, near Vernon, Lamar county.

No. 4.—An oolitic limonite. Color, dark brown. Streak, brownish red. Locality, one mile east of Russellville, Franklin county.

No. 5.—A limonite, with exterior surface smooth, glazed. Outer shell, of radiating fibrous texture. Interior, compact, with striæ through it. Exterior surface, black. Fractured surface, a dark liver color—brittle and very hard. Streak, dark brown. Locality, near Russelville, Franklin county.

No. 6.—A nodular, argillaceous, compact mass of brown clay iron-stone, with white streaks running through it in different directions. Color, a dull reddish brown, with a stony look externally. Streak, a yellowish brown. Locality, head-waters of Clear Creek, Winston county.

Bat Guano.

Analysis:—	Moisture	61.016
	Organic matter and combined water	26.473
	Phosphoric acid	2.270
	Sulphuric acid	.217
	Ammonia	.668
	Nitrogen, existing as Uric Acid, etc	5.796
	Lime	1.524
	Magnesia	.171
	Potash and Soda	1.450
	Insoluble matter, sand, etc	.335
		99.923

Locality, North Alabama.

APPENDIX.

List of Elevations above Mobile Bay, together with Distances from Memphis of the Stations on the Memphis and Charleston Railroad.

Stevenson,	Ala	271.0	miles	602.80 feet.
Bellefonte,	"	259.0	"	639.19 "
Scott's Mills,	"	254.0	"	651.84 "
Larkin's,	"	247.7	"	620.45 "
Woodville,	"	237.3	"	600.68 "
Paint Rock,	"	232.9	"	595.68 "
Brownsboro,	"	223.3	"	630.76 "
HUNTSVILLE,	"	211 6	"	612.14 "
Madison,	"	202.5	"	573.13 "
Moore's,	"	192.5	"	601.32 "
DECATUR,	"	188.0	"	572.89 "
Trinity,	"	182.0	"	633.61 "
Hillsboro,	"	176.5	"	598.61 "
Courtland,	"	168.5	"	560.21 "
Jonesboro,	"	163.0	"	560.41 "
Leighton,	"	155.5	"	562.71 "
TUSCUMBIA,	"	145.0	"	468.25 "
Barton,	"	133.3	"	497.79 "
Dickson,	"	126.6	"	487.71 "
Iuka,	Miss	114.8	"	554.85 "
Burns,	"	107.3	"	463.10 "
Glendale,	"	99.0	"	494.61 "
CORINTH,	"	92.8	"	434.12 "
Chawalla,	Tenn	83.7	"	408.61 "
Pocahontas,	"	74.4	"	394.31 "
Middleton,	"	69.3	"	407.13 "
Saulsberry,	"	57.6	"	535.51 "
GRAND JUNC.,	"	52.0	"	574.91 "
La Grange,	"	49.0	"	530.74 "
Moscow,	"	39.0	"	351.74 "
Lafayette,	"	30.9	"	315.54 "
Collierville,	"	23.8	"	378.54 "
Germantown,	"	14.5	"	377.89 "
Buntyn,	"	5.5	"	303.54 "
MEMPHIS,	"	0.0	"	245.44 "
High water of the Mississippi at Memphis				220.44 "
Low water	"	"	"	170.44 "?

THE END.

GEOLOGICAL SURVEY

—OF—

ALABAMA.

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BY
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STATE GEOLOGIST.

MONTGOMERY, ALA.:
ALLRED & BEERS, STATE PRINTERS.
1881.

WITH THE COMPLIMENTS OF
EUGENE A. SMITH,
State Geologist,
University of Alabama,
Tuscaloosa County, Ala.
Please acknowledge receipt.

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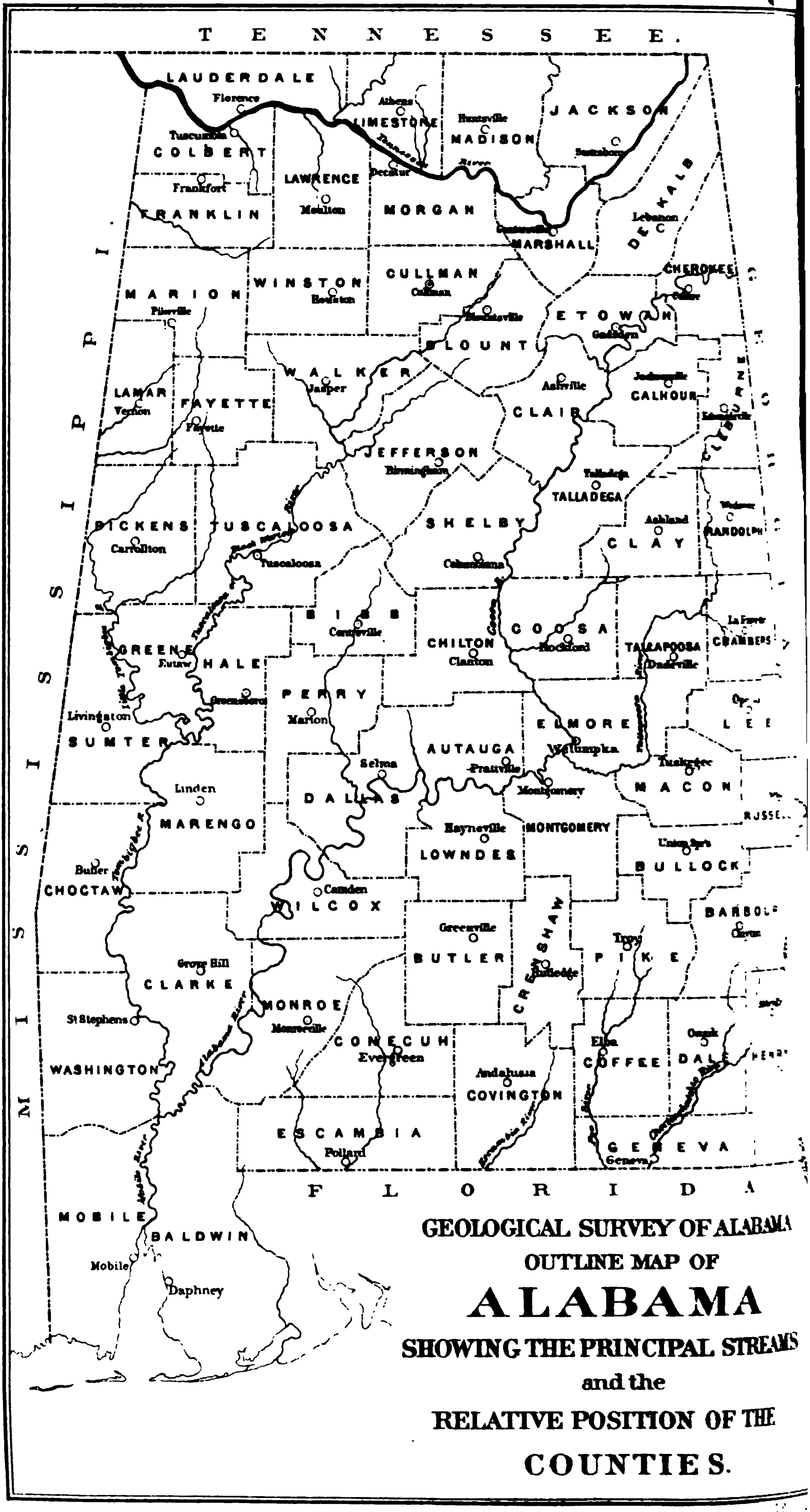

GEOLOGICAL SURVEY OF ALABAMA
OUTLINE MAP OF
ALABAMA
SHOWING THE PRINCIPAL STREAMS
and the
RELATIVE POSITION OF THE
COUNTIES.

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To His Excellency,

RUFUS W. COBB,

Governor of Alabama:

SIR—The Report of Progress of the Geological Survey, for the years 1879 and 1880, is herewith respectfully submitted.

I have the honor to be, sir,

Your obedient servant,

EUGENE A. SMITH,

State Geologist.

UNIVERSITY OF ALABAMA,

December 31, 1880.

TABLE OF CONTENTS.

PREFACE.

In accordance with the plan followed in previous years, the present Report continues the description of the Coal Measures of the Warrior Field.

A survey of the Warrior River, from Tuscaloosa to the Sipsey Fork, under the auspices of the War Department, was carried out during the summer months of 1879, by myself, with the assistance of Prof. Henry McCalley and Mr. Joseph Squire.

The object of the survey was, primarily, to ascertain the nature and extent of the obstructions to navigation, and to obtain estimates of the cost of removing or overcoming the same, and, incidentally, to collect statistics of the natural resources of the country, lying adjacent to the River.

In view of the fact that the Reports of the Chief of Engineers have a limited circulation, the consent of Maj. Damrell, by whom the survey was instituted, was obtained—to re-publish for the State, the geological details thus collected, and the present Report is substantially a re-production of one made last winter to Maj. Damrell, embodying the results of the Survey above mentioned.

The constantly increasing demand for information about the almost unknown and unexplored region of the Warrior Field, renders unnecessary any further explanation of the fact that the survey has, for several years, been devoted chiefly to the task of collecting and publishing statistics bearing upon what is destined, in the near future, to be one of the most important industries of the State.

The accompanying map is a copy of one submitted to Maj. Damrell, but with the addition of many geological details, collected since the summer of 1879. In its topography it is probably more nearly correct than any other map of the same region, having been taken from the original plats, and the meanderings of the river having been carefully platted from the original field notes. Upon the map are shown all the localities where outcrops of coal have been observed and

measured, the adjoining figures giving the thickness of the bed.

The figures at head and foot of each shoal show the elevation above low water mark at Tuscaloosa. The levelings were made by a party in charge of Prof. Henry McCalley, to whom the whole credit of this laborious and difficult work is due.

The geological statistics were collected by myself, in conjunction with Mr. Joseph Squire, of Helena, Ala., a gentleman well known for the accuracy and trustworthiness of all his work.

To this is added a Report by Henry McCalley, upon the counties lying north of the Tennessee River. Geological maps of these counties are in course of preparation, and will be published in due time.

It is proper to state that Prof. McCalley's report is a gratuitous contribution.

The outline map of the State is inserted for the convenience of readers not familiar with the relative positions of the counties, and it will accompany all future reports.

Through no fault of the printers, but by an oversight of my own, the following errors occur: At the end of the General Section, p. 16, St. Louis Group should read Chester Group.

The differences of elevation as given on pages 18, 33, and 42 are not quite correct, but the true numbers can be obtained from the map.

To Maj. A. N. Damrell, U. S. Engineer, Mobile, Alabama, acknowledgments are hereby made, for his courtesy in turning over, to the use of the State, the results obtained by a survey instituted and carried out under his general direction.

The authorities of the Alabama Great Southern, and of the South and North Alabama Railroads, have placed the survey under obligations for continued favors.

University of Alabama, December 31, 1880.

REPORT.

I.

TOPOGRAPHY AND ECONOMICAL RFSOURCES OF THE WARRIOR RIVER REGION, BETWEEN TUSCALOOSA AND SIPSEY FORK.

By a reference to the map accompanying this report, it will be seen that the Warrior, between the Sipsey Fork and Tuskaloosa, has cut its channel altogether into rocks of the Coal Measures, and that by reason of the varying degrees of hardness of the rocks traversed, the fall between the two points, averaging only 1¾ feet to the mile, is very unequally distributed. The entire fall being 163.84 feet, a fall of 65 feet is found within the first twenty-five miles from Tuskaloosa; of 107 feet, within thirty-one miles and of 129.5 feet to the head of the Fork Shoal, about half the distance, or 48 miles. For the remaining 44 miles the difference in level is only a little more than 34 feet.

In accordance with these facts, we find the lower part of the river, from the head of Squaw Shoals to Tuskaloosa, much straighter, and with comparatively little bottom land.

Above these great shoals, the course of the river is much more winding; there are great bends with large areas of fertile land, especially where the fall of the river is comparatively slight.

Our previous knowledge of the material resources of the country drained by this part of the river, and the present condition of traffic by the river.

It has long been known that coal of good quality and in

beds of sufficient thickness, could be found within easy reach of the river, almost the entire distance between Tuskaloosa and Sipsey Fork. Before the introduction of railroads into the State, it was the custom in those parts of Tuskaloosa, Jefferson and Walker counties lying adjacent to the river, for the inhabitants during the summer months to build boats or barges, along the banks of the river, or near the mouths of creeks and other streams emptying into the river, to fill these boats with coal raised in the immediate vicinity, and when the water rose sufficiently high to float the barges, they were guided down the river, the coal finding its principal market in Mobile. Besides the coal, other articles, such as cotton, staves, &c., found their way to a market by the same channel.

This business was precarious at best, because of uncertainty as to time and sufficiency of highwater, and the shooting of the falls, in particular those near the foot of Squaw Shoals, being attended with much danger to property and with some risk of life, this mode of transportation has gradually been abandoned, farmers preferring to haul their produce to Birmingham, Tuskaloosa and other markets, whilst the shipping of coal has ceased entirely.

It needs hardly be said that the chief result of the improvement of the Warror river, would be the development of coal trade. As to the probable extent of this trade, there have hitherto been no means of forming an opinion. The number, locality, value and accessibility of the coal deposits were not definitely known; only the most vague and unreliable reports could be obtained upon these points.

For these reasons, it was thought important in the present survey, to collect as much as possible of accurate and detailed information concerning the quantity and quality of the coal accessible from the river, in order that a correct judgment might be formed as to whether the expenses of the river improvement would be justified by the attainable results.

To this end the attention of the reader is particularly called to the following facts about the coal beds near the river, which have either been collected by the present survey, or which form part of published or yet unpublished material of the State Geological Survey.

II.

GENERAL GEOLOGICAL DESCRIPTION OF THE WARRIOR COAL FIELD.

Before entering into details, a few general remarks concerning the area and the general character of the Warrior Coal Field will not be out of place, but will, on the contrary assist to a correct appreciation of much that follows.

The area of the Warrior river is usually estimated at 5,000 square miles; of this, 3,500 square miles are drained directly by the Warrior and its tributaries, and this area of Coal Measures would be opened to the outside world by the proposed improvement of the river.

Of the actual number of the coal seams traversed by the river, we cannot, as yet, be *certain*, our knowledge is too limited; but it is possible by giving a general description of this basin, together with a measured section obtained in that part of the field whose mining operations have been most extensively carried on, and then by giving the details lately collected, to place in the hands of an intelligent reader, the means of forming an approximately correct judgment concerning the capabilities of this great and almost unknown field.

By reference to a Geological Map of Alabama, it will be seen that the Coal Measures of the State are divided into three distinct fields, separated by long narrow valleys running northeast and southwest, in which the strata of formations older than the Coal Measures form the surface rocks. These three fields have been named by Prof. Tuomey, from

the rivers that drain them, the Coosa, the Cahaba and the Warrior fields. The Geological Map will show also that the Warrior field itself is divided into several distinct parts by similar long and narrow valleys—Wills', Murphrees' and Brown's.

The significance of these valleys will be best understood by recalling some of the more important points in the geological history of the Appalachian chain, of which a part of the southwestern end is formed by our Coal Measures.

During the long geological period which preceded the elevation of the Appalachians, the area occupied by this chain was alternately a coal marsh, a lake, or an arm of the sea, into which sediments were brought down from north, east and west, until 10,000 feet or more were deposited. (LeConte.) During the whole of this time this area was slowly subsiding, so as to maintain nearly the same level. At the end of the Coal period, occurred what has been called the Appalachian revolution. The great mass of sediments accumulated as above described, yielded to pressure, was crushed together and folded and swollen upwards, forming the Appalachian chain. (LeConte.)

The Coal Measures of Alabama, forming a part of this uplifted area, were crushed and thrown like the rest into long, narrow folds or wrinkles running approximately parallel to the general direction of the chain, i. e. northeast and southwest. Some of these were simple folds, others were broken or rent along the crest line, thus giving a channel for denuding waters, which have subsequently eroded them down into valleys, in which the strata on each side slope away from the central line, (anti-clinal valleys.) In other cases, the fracture being more profound, the strata on one side of the line of fissure have slipped below, or have been pushed up above the same beds on the other side of this fissure producing what are known as *faults*.

The long, narrow valleys spoken of above, as dividing the Cahaba from the Warrior field, and the Warrior field itself

into distinct parts, are instances of these anti-clinal valleys. But the Coosa field is separated from the Cahaba by a fault in which the displacement is so great as to bring to the same level, the Lower Silurian rocks and those of the Coal Measures.

The only one of these valleys in which we are interested in this connection is Brown's. This is the continuation into Alabama, of the great Sequatchee valley of Tennessee. It ends *as a valley* near Blount Springs, but the great fold, of which it is the eroded or scooped out part, continues southwestward *as a ridge* towards the confluence of the two branches of the Warrior. Below Blount Springs it can be traced for some distance, but it gradually sinks away into the general level of the country.

The Warrior Field has, for convenience, been divided into the Plateau or Table Land region, and the Warrior Basin. There is, of course, no sharp line of division between these two parts, the Plateaus sinking gradually into the Basin proper, still we may assume that the Plateaus extend southwestward as far as the conglomerates in the lower part of the Measures from the surface rocks, and where the underlying Sub-Carboniferous limestones lie above or near the general drainage level of the country.

Upon this principle the Measures in Jackson, DeKalb, Marshall, Morgan, Blount and the eastern half of Winston, and the northeastern corners of Walker and Jefferson counties, together with those forming the northern rim of the Warrior field in Lawrence, Winston, Franklin and Marion counties would be assigned to the Plateau region, whilst those of the rest of Winston, Walker and Jefferson, and all of Tuskaloosa and parts of Fayette and Marion counties, would belong to the Warrior Basin.

It is the Warrior Basin proper which would be opened by a navigable river, and it is this part of the field, therefore, to which the present report will be devoted.

From what has been said above, it will be seen that Brown's

valley and its prolongation southwestward as a low ridge, divides the Warrior basin into two parts of unequal area, viz: a narrow strip drained by the Locust Fork, or Little Warrior, lying southeast of the anti-clinal ridge, and the wide expanse of the basin on the northwest drained by the Mulberry Fork or Big Warrior, with its tributaries. Of these two parts, the southern, or that drained by the Little River, has been most thoroughly explored, especially along the line of the South and North railroad, and in the vicinity of Birmingham. We shall therefore give first a general section of this part of the Basin, (taken from my Report for 1877-78,) showing approximately the number of coal seams and the thickness of the Measures in this part of the State, after which, the seams occurring in other parts of the Basin will be described and, wherever it is possible to do so, referred to their proper position in the general section.

General Section of that part of the Warrior Basin lying between the Locust Fork and Jones' Valley.

Surface soil—of variable depth.......	—	—
COAL, *Guide Seam*........................	0 ft.	3 inches
Sandstones, Shales, &c..................	115 "	0 "
COAL, *Pratt Seam*........................	4 "	8 "
Sandstones, &c............................	20 "	0 "
COAL, *Sixteen Inch Seam*..............	1 "	4 "
Sandstones, Shales, &c..................	30 "	0 "
COAL, ...	2 "	4 "
Sandstones, &c............................	5 "	0 "
COAL, *Four Foot Seam* in two benches of equal thickness with 8-inch slate parting............................	4 "	8 "
Sandstones, Shales, &c..................	50 "	0 "
COAL, *Quadruple Seam*............	6 or 7 "	0 "
Sandstones and other measures...	20 or 30 "	0 "
COAL, *Slaty Seam*........................	1 "	6 "
Sandstones, &c............................	35 "	0 "

COAL, slaty, one bench 2 ft. thick.....	8 ft.	0 in.
Sandstones, &c..........................	100 "	0 "
COAL, *Double Seam*, two seams, 8 in. and 15 in., with 5 feet of shale between..........................	7 "	0 "
Sandstones, &c..........................	100 "	0 "
Shales..........................	25 "	0 "
COAL, good..........................	4 "	6 "
Sandstones, &c.......................25 to	30 "	0 "
COAL, small seam.................... 1 or	2 "	0 "
Shales, &c.......................... 6 to	10 "	0 "
COAL, in two benches of 3 and 15 in., with 2 or 3 feet of slate between...	4 "	0 "
Sandstones, &c..........................	100 "	0 "
COAL..........................	2 "	2 "
Shales and other measures..............	50 "	0 "
COAL, double seam, thickness unknown..........................	—	—
Sandstones, Shales, &c..................	300 "	0 "
COAL, *Newcastle Seam*, (slaty)...5' 8" to	6 "	3 "
Sandstones, &c..........................	15 "	0 "
COAL, poor..........................	1 "	10 "
Fire-clay 3 ft., and Sandstones 20 ft.	23 "	0 "
COAL..........................	2 "	6 "
Sandstones, &c..........................	25 "	0 "
BLACK BAND IRON ORE..................	1 "	4 "
Sandstones..........................	20 "	0 "
COAL, poor, full of slate................	4 "	9 "
Fire-clay and arenaceous clays...20 to	30 "	0 "
CONGLOMERATE.......................16 to	20 "	0 "
COAL, with shale..........................	1 "	6 "
Sandstones, shales, &c..................	81 "	10 "
COAL, good, hard..........................	1 "	6 "
Sandstones..........................	40 "	6 "
COAL, good, *Jefferson Seam*............	3 "	3 "
Sandstones, &c..........................	29 "	5 "

COAL, good, *Black Creek Seam*.........	2	ft. 6	in.
Sandstones, &c..............................	139	" 0	"
COAL, doubtful..............................	1	" 6	"
Sandstones, with fossil shells..........	85	" 0	"
COAL	1	" 2	"
Sandstones, &c..............................	30	" 0	"
CANNEL COAL and BLACK BAND......	2	" 4	"
Slate, hard..................................	4	" 0	"
COAL, good, *Warrior Seam*.............	2	" 9	"
Clays, sands, &c...........................	20	" 5	"
COAL	1	" 8	"
Clay and sandstone........................	7	" 6	"
COAL, hard..................................	2	" 2	"
Shales, sandstones, &c....................	295	" 6	"
COAL, hard and bright....................	1	" 6	"
Sandstone and fire-clay..................	17	" 0	"
COAL	1	" 4	"
Shales, with coal plants.........	12	" 0	"
COAL, good..................................	2	" 6	"
Standstones, clays, &c....................	102	" 7	"
Shales and sandstones, with two thin seams of coal near bottom of the series	450	" 0	"
Siliceous sandstone, often a conglomerate, base of Coal Measures.........	100	" 0	"

Below these follow:

SUB-CARBONIFEROUS ST. LOUIS GROUP	Shales	80	" 0	"
	Limestone, with Pentranites......	75	" 0	"
	Silic. sandstones...	60	" 0	"

In this section there are about 2,600 feet of Coal Measures, including between thirty and thirty-five seams of coal. Five of these seams have been extensively mined.

III.

SPECIAL DESCRIPTION OF THAT PART OF THE WARRIOR BASIN, LYING ADJACENT TO THE RIVER, BETWEEN TUSCALOOSA AND SIPSEY FORK.

The area here indicated, includes parts of the counties of Tuskaloosa, Jefferson and Walker.

As to the position of the coal seams of the central and southwestern part of the basin, very little can as yet be said with certainty.

Whilst in many parts of this basin, it appears in the present state of our knowledge, that only the lower seams of the general section (below the Newcastle) occur, yet is the opinion of Mr. Joseph Squire, who has had much experience in the examination of the coal measures of the State, and whose judgments are generally very correct, that the *Pratt Seam* (near top of the General Section) occurs in the vicinity of Old Warrior Town. If this surmise be correct, then we have in part, at least, of the area drained by the Big Warrior, the full series of measures as given in the preceding general section. Over what extent of country these upper measures, including the Pratt Seam, will hereafter be found to spread, can, at this time, be only a matter of conjecture.

As the best manner of presenting the resources of the country adjacent to the river, I shall give the localities of actual outcrops of coal along the river, together with sections of the seams, and analyses of *average samples* of the entire thickness of each seam, wherever it has been possible to obtain such samples. It must be understood, however, that these analyses show the quality of the coal, not in its freshly-mined condition, but after having been exposed for an indefinite length of time to the influence of the weather. This will be understood when it is said that all the samples have been taken from surface outcrops, because in the great majority of cases the seams have not been worked and the coal was accessible near the surface only.

Bearing these things in mind, it will be seen that whilst the accompanying analyses may be considered as representing fairly well the relative values of the different coals, they do not show the actual composition of the *freshly mined* coal, having been made in every case from more or less weathered samples.

A few words more concerning the method of selecting the samples for analysis. In every case where the contrary is not expressly stated, the full thickness of the seam was laid bare, then a stripping was made from top to bottom of the seam, including the thin layers of shale, such as would not be separated from the coal in mining. This sample of the entire seam, including the thin layers of slate or shale, was, in the laboratory, run through a small Blake crusher, and the coarse powder thus obtained, was then thoroughly mixed and separated into five piles. One of these was again divided into five parts, and this method was continued until a pile of proper size for analysis was reached. Thus, an *average sample* of the original average sample of the entire seam was always obtained for analysis. In this way, therefore, we may be sure that the following analyses show what would be the character of the coal *as it would come from the mine*, and not of picked specimens.

I may also state that as the samples were taken in almost every case from more or less weathered outcrops, the percentage of *ash* in the analyses is uniformily greater than it would be if the analyses had been made from freshly-mined, unweathered samples. The high percentage of moisture, in many of the analyses, shows where the samples have been particularly badly weathered. From these causes it will be seen that the coal mined from any of the seams examined and here reported upon, will always be of better quality than is indicated by the analyses.

Section 1. *From Tuskaloosa to the foot of Squaw Shoals. Distance* 26 *miles. Difference of Elevation* 70 *feet.*

By reason of a fault in the measures, by which there is a

vertical displacement of about 55 feet, it is not yet certainly known whether there are two or three seams at Tuskaloosa. Thus, back of the Insane Hospital, a seam has been worked by drifts 75 feet or above the level of the river, and another is now worked in a shaft 60 feet deep and 20 feet perhaps below river level. At the McLester Shaft, also, near the town of Tuskaloosa, a seam is worked which is like the lower seam at the Asylum, in being below a conglomerate, whilst it differs from the Asylum seam in having very little slate and also in the character of the coal.

Coal from McLester Shaft.

Specific Gravity	1.283
Sulphur	1.861
Moisture	2.245
Volatile Matter	35.130
Fixed Carbon	55.301
Ash	7.324
	100.000

A sample of the coal from the Asylum Shaft, upon analysis, gave the following result:

Coal from Asylum Shaft.

Specific gravity	1.397
Sulphur	1.867
Moisture	1.892
Volatile Matter	32.011
Fixed Carbon	55.364
Ash	10.733
	100.000

I give below a section of the Measures in the vicinity of Tuskaloosa. In this section the Asylum seam and the McLester seam are assumed to be the same, though they may be distinct seams. The miners are all of the opinion that they are distinct; and that the Asylum seam is 75 to 80 feet below the McLester.

Section near Tuskaloosa.

Surface. Drift, pebbles, etc.		
Soft sandstones..........................	50 ft.	0 in.
COAL, upper bed, formerly worked by drifts, thickness unknown.		
Sandstone and conglomerate (the latter in places, at least 50 ft. thick).	100 ft.	0 in.
COAL, lower bed, Asylum shaft (may be same as McLester shaft)..........		26–18 "

On the oppostie side of the river, and about two miles from Tuskaloosa, in section 15, T. 21, R. 10, W., occurs a seam of coal, long worked at what is known as the Hewell mine. This coal enjoys a good reputation, but I am not able to give a detailed section of the seam or an analysis of the coal.

Above Tuskaloosa, in T. 21, R. 9, W., we find many openings upon a thin seam of very excellent grate coal. This seam is worked by drifts in the rudest possible manner. The outcrops are along the tributaries of Hurricane Creek in sections 10, 15, 16, and 22 of this township. At all these places the coal has much the same character and the following sections and analyses will answer for many.

Section at Prude's Lower Mine.

Heavy bedded sandstone roof, the upper part of which is a conglomerate.

Gritty slate..................................	0 ft.	3½	in.
COAL, good, hard, free from slate.....	0 "	10	"
Parting	—	—	
COAL, softer but very good...............	0	8	"
Clay slate bottom.			

Analysis of Coal from Prude's Lower Mine.

Specific gravity	1.327
Sulphur	.626
Moisture	5.426
Volatile matter	31.952
Fixed Carbon	59.455
Ash	3.167
	100.000

Section at Mrs. Chambers' Mine.

Heavy bedded sandstone roof.

Gritty slate	1 ft. 8 in.
COAL	1 " 3 "

Clay slate bottom.

Analysis of Coal from Chambers' Mine.

Specific gravity	1.281
Sulphur	2.380
Moisture	1.838
Volatile matter	30.682
Fixed Carbon	64.339
Ash	3.141
	100.000

This seam having in most places a massive sandstone roof is easily mined, and being entirely free from slate, it is one of the best coals for domestic use, brought to the Tuskaloosa market. Other openings on this seam are known as the Foster and Keene mines.

In the northeast corner of this township and the adjoining parts of T. 21, R. 8, and T. 20, R. 9, are many openings principally upon what is known as the University seam.

The following sections will show the character of this seam.

Section of Goree bed, S. 7, T. 21, R. 8, Tuskaloosa Co.

Yellow gritty slate several feet thick.

	ft.	in.
COAL	0	1
Decomposed yellow clay slate	3	0
COAL, in cubical blocks	0	2
Blue clay slate	1	2
COAL	0	3
Blue clay slate	1	3
Shaly coal	0	2
COAL, with cubical fracture or jointing.	1	4
Slate	0	1
COAL, good, slightly bony	1	1

Blue, gritty fossiliferous slate bottom.

Section of University Seam at University Mine, S. 2, T. 21, R. 9, West.

Heavy bedded sandstone above.

	ft.	in.
Hard slate	15	0
Soft, gritty fossiliferous slate	2	0
COAL, good	0	10
Slate	0	¾
COAL	0	1
Slate	0	2
COAL	0	3½
Slate	0	8
COAL, good, hard	0	9
COAL, rather bony	0	3
Very black bituminous shale, the upper part a very bony coal	0	9

A lower bench of coal ixists, but could not be seen here.

At the *Ashe Mine* in this vicinity, the following section has been obtained:

Coarse grained heavy bedded.		
Sandstone with layers of conglomerate.	3 ft.	0 in.
Clay slate	0 "	3 "
Bituminous shale	0 "	1 "
Clay slate	0 "	3 "
COAL	0 "	2 "
Slate, compact	0 "	8 "
COAL	0 "	2 "
Slate	0 "	8 "
COAL, main bench, 15 in. seen, said to be	2 "	0 "

On the opposite (north) side of the river, the same seam ιas been opened in several places. Thus, near the mouth ıf Yellow Creek, S. 35, T. 20, R. 9, W., at what is known as he *Peacock Mine*, it shows the following section:

	ft.	in.
Gritty slate roof, at least	20	0
Soft, gritty, fossiliferous slate	0	10
Parting slate	0	1
COAL, good	0	7
Slate	0	¼
COAL	0	1½
Slate	0	½
COAL, good	0	3½
Black Shale	0	2½
COAL, good	0	10
Curly, gritty slate bottom.		

Also on Jim Mack's branch in same section as above, the ɪed is exposed in the bluff of the branch and exhibits the ollowing section:

Section of University Seam on Jim Mack's Branch, S. 35, T. 20, R. 9, W.

	ft.	in.
Gritty slate	20	0
Parting slate	0	1
COAL, good	0	8½

	ft.	in.
Slate..	0	¾
COAL, good..	0	5½
Slate..	0	4
COAL, good cubical blocks.....................	0	9½
Bony coal..	0	1½
Black Shale..	0	2½
COAL..	0	11
Slate..	0	3
COAL..	0	2
Black Shale..	0	3
Bottom Slate.		

The following analyses made from samples taken of the entire thickness of the seam, will show sufficiently well the character of the coal.

Analysis of coal from the University Seam :

	1	2	3
Specific gravity..........	1.386	1.298	1.393
Sulphur.....................	.870	1.038	.765
Moisture.................	2.062	1.833	7.285
Volatile matter..........	31.103	36.233	28.989
Fixed carbon............	55.495	54.534	54.522
Ash.........................	11.340	7.400	9.204
	100.000	100.000	100.000

No. 1. From Goree bed.

No. 2. " University mine, excepting the lowest structure.

No. 3. " Jim Mack's branch.

On the south side of the river in the vicinity of the University Mine, another seam of coal, some 25 feet or more below the University seam, has been worked to a limited extent, at the Manly opening. A section of this seam is as follows :

Section at the Manly Bed, S. 1, T. 21, R. 9, W.

Very coarse grained, dark grey sandstone with some pebbles in it, at least	20 ft 0 inches
Gritty slate, ferruginous stains on joint surfaces	2 " 6 "
COAL, excellent, free from slate	1 " 6 "

An analysis of an average sample of coal from this place, shows the following composition in 100 parts:

Specific gravity	1.277
Sulphur	.752
Moisture	2.004
Volatile matter	33.833
Fixed carbon	61.872
Ash	2.291
	100.000

In the bed of the river, at Ward's Shoals, and twenty-five or thirty feet below the University seam, is another seam from which some coal has been raised. This may be the same as the Manly seam.

On the north side of the river, on the Jim Mack branch and twenty-five or thirty feet above the University seam, there is another smaller seam of six inches thickness, imbedded in slaty sandstones.

The following general section of the measures on both sides of the river, and near the mouth of Hurricane Creek, is here given to show the relative positions of the coal seams above described:

Approximate general section of the Measures in vicinity of mouth of Hurricane Creek, Tuskaloosa County.

Conglomerate	10 to 15 ft.
Heavy bed sandstone (slaty above.)	50 "

(4) COAL, (*Prude, Foster, Chambers, &c.*)	1½ to 2 feet
Slaty sandstones, with conglomerate	60 to 70 "
(3) COAL, (*upper seam, Jim Mack's branch.*)	6 in.
Slaty sandstones, &c..................	25 to 30 "
(2) COAL, (*University Seam, Goree, Ashe, &c.*)...........................	3 to 4 feet
Measures................................	25 "
(1) COAL (*Manly seam,* and *in bed of river.*)	1 foot 6 in.

On the northern side of the river, near Yellow Creek, several seams have been opened and small quantities of coal raised from them.

In S. 27, T. 20, R. 9, W., the following section was made of what has been called the *Block Coal Seam:*

Blue slate, in places resembling soapstone.

COAL, slightly bony, top very bony......	2 feet	0 inches
Soft slate..	0 "	2 inches
COAL..	0 "	3 inches
Slate..	0 "	1 inch.
BLOCK COAL..	0 "	4 inches

An analysis shows the following composition—sample much weathered:

Analysis of coal from *Block Coal Seam.*

Specific gravity..	1.411
Sulphur..	1.613
Moisture..	2.239
Volatile matter..	34.606
Fixed carbon..	50.375
Ash..	12.780
	100.000

In the same neighborhood is what has been called the *Double Seam,* of which the following is the section:

Slaty sandstone (sometimes conglomerate)	5 feet	0	in.
COAL, good	0 "	8	"
Slate parting	0 "	½	"
COAL,	0 "	2	"
Slate parting	0 "	¾	"
COAL	0 "	5	"
Dark, hard, curly slate, fossilferous	2 "	0	"
COAL, all good, free from slate	1 "	2	"
Slate bottom.			

An analysis of this coal shows the following composition in 100 parts:

Coal From Double Seam.

Specific Gravity	1.304
Sulphur	2.129
Moisture	1.810
Volatile Matter	34.029
Fixed Carbon	58.240
Ash	5.921
	100.000

This coal has the reputation of being the best coal near Tuskaloosa, on the river, except that from an underlying seam which is said to be 2 feet thick.

The following approximate general section of the measures on Yellow Creek, in the Jacob Snider settlement, will show the relative position of the seams exposed in Sections 20, 21, 22, 27, 28, etc., in T. 20, R. 9, W. The connection between this section and that given for the opposite side of the river, is not yet certainly made out; it seems probable, however, that the Block Coal seam and the University seam are the same.

General Section of the Measures on Lower Yellow Creek in the Jacob Snider settlement, S. 28, etc., T. 20, R. 9, W.

Orange Sand, or Stratified Drift, pebbles and sand, Blue Slate, on dry hills becoming like blue soapstone.

(3) COAL, *Block Coal Seam* (Univ. seam?) 2 ft. 6 in. to 2 ft. 9 in.

Sandstone, coarse grained in lower part 35 "

Coarse sandstone and conglomerate, most of it conglomerate with many black pebbles.......... 25 "

Sometimes five feet of slaty sandstone follow this; but sometimes it is wanting and the conglomerate lies directly over the coal.

COAL...........	14 in.		
(2) Sulphury slate	24 "	Double Seam	4 ft. 4 in.
COAL...........	14 "		

Bottom Slate.

Massive sandstone, part laminated forming cliffs.......... 80 "

COAL, said to be very free from slate.... 2 "

Level of water in Yellow Creek.

Nearly opposite the mouth of Daniel's Creek, in S. 13, T. 20, R. 9, W., near James Beavers', a seam occurs, said to be twenty inches in thickness.

An analysis of this coal shows the following composition in 100 parts:

Specific Gravity..........	1.311
Sulphur..........	.660
Moisture..........	2.513
Volatile Matter..........	31.977
Fixed Carbon..........	60.033
Ash..........	5.477
	100.000

On the eastern side of the river on Daniel's Creek, one or two miles from the river, there is said to be a thick seam of coal, from which, however, no samples have been taken for analysis. Further up the Creek, and near the Plank Road,

is a seam of coal which greatly resembles *Cannel coal*, of which the following analysis shows the composition:

Specific Gravity	1.348
Sulphur	2.752
Moisture	.830
Volatile Matter	36.207
Fixed Carbon	48.319
Ash	14.644
	100.000

In sections 25, 26, 35 and 36, of T. 20, R. 8, W., and in sections 1 and 2, of T. 21, R. 8, are at least two, and probably three distinct seams of coal.

One of these seams is three feet in thickness and has afforded some excellent coal to the Tuskaloosa market. So, also, in the same Township 20 and in R. 7, W., are occurrences of coal seams of great interest, but lying as they do at a distance of five or six miles from the river, I shall pass them over with a few notes concerning the thickness of the beds. No analyses have been made.

In the northeast corner of S. 9, and southwest corner of 18, two sections have been accurately measured. The first is called *Burchfield No.* 1, and the second, the *Haldman Bed*. From the similarity of these sections it seems probable that they are of the same seam.

Sandstone roof

	1	2
COAL	13 inches	17 inches
Slate	3 "	2 "
COAL	9 "	9½ "
Slate	2 "	1½ "
COAL	7½ "	10 "
Slate	2½ "	½ "
COAL	15 "	12 "
Clay	22 "	36 "
COAL	19 "	18 "

Fire clay bottom

There is reason for believing that the thick seam of coal reported as occurring on Daniel's Creek, near the river, is the same as this.

In section 19 of this township 20, R. 7, W., the following measurements were made:

Surface.

COAL	1 ft.	3 in.	
Slate	0 "	½ "	
COAL	0 "	6 "	Burchfield No. 3.
Slate	0 "	1 "	
Coal	1 "	7½ "	

Fire clay.

Sandstone, etc	20 ft.	4 in.	
COAL	2 "	4 "	Burchfield No. 2.

Fire clay.

In the southeast corner of Sec. 30, same township and range, we get the following section of what has been called the Jones Bed.

Slate roof.

COAL	0 ft.	9 in.
Slate	0 "	7 "
COAL	0 "	10 "
Fire clay	3 "	6 "
COAL	1 "	7 "
Slate	0 "	½ "
COAL	0 "	11 "
Slate	0 "	1 "
COAL	1 "	3 "

In Sec. 27 the following measurements were made of the *Hart Bed.*

Sandstone roof.

COAL	1 ft.	8 in.
Slate	0 "	1 "
COAL	0 "	7½ "
Slate	0 "	1 "
COAL	0 "	9 "

Some distance down the branch from this outcrop, another bed has been exposed, of which the following measurements were taken:

Thomas Bed.	Sandstone roof	
	Coal	1 ft. 7½ in.
	Slate	0 " 1 "
	Coal	1 " 1 "
	Bottom	

About 15 feet below this, and separated from it by slates, is a small seam, 2–4 inches in thickness. On Brush Creek, several small seams have been observed, which lie between the beds above given and the Warrior River.

From the above given measurements the following section has been constructed, which shows approximately the relations of the seams in this vicinity.

Section of the Measures in T. 20, R. 7 and 8, Tuskaloosa County.

	Surface rocks		
(9)	Coal, Cleveland Bed (?)	2 ft.	4 in.
	Sandstones, &c	40 "	0 "
(8)	Coal. (*Jones', Hart's, Burchfield No. 3,*) 3 ft. to.	3 "	8 "
	Sandstones and other measures	20 "	0 "
(7)	Coal, (*Peterson's Burchfield No. 2,*)	2 "	4 "
	Sandstones	25 "	0 "
(6)	Coal, (*Thomas, Holdman, Burchfield No. 1,*)	6 "	6 "
	Shales and Slates	15 "	0 "
(5)	Coal	0 "	2 to 4 in.
	Sandstone, &c., (estimated)	30 "	0 "
(4)	Coal	0 "	10 "
	Sandstones, etc	150 "	9 "
(3)	Coal	0 "	3 "
	Sandstones	10 "	3 "
(2)	Coal	0 "	10 "
	Sandstones	100 (?)	0 "
(1)	Coal	0 "	4 "
	Water level, Warrior River.		

Between Daniel's and Davis' Creeks, in the immediate vicinity of the river, no coal outcrops have been observed. The country is made up chiefly of massive sandstones, and it is exceedingly broken and rugged.

Near *Mat Christian's, on the Watermelon road,* the following section was made:

Coal	1 ft.	2 in.
Dark Slate	0 "	6 "
Coal	0 "	1½ "
Dark Slate	0 "	3 "
Coal	0 "	4 "
Bottom slate.		

Near Prince Christian's, S. 14, T. 19, R. 9., W., occurs a seam of coal 14 inches in thickness. An analysis of this coal is given further on. This seam is supposed to be same as the upper seam of the Blue Creek section given below.

On Panther Branch, near its confluence with the river (S. 8, T. 19, R. 8 W.), a seam of coal has been examined which is probably the lower seam of the Blue Creek section.

From a number of examinations of coal outcroppings, near Blue Creek, in the Alexander McMillan's neighborhood, the following approximate general section of the Measures in this locality, has been constructed.

Section of the Coal Measures on Blue Creek, Tuskaloosa County, near Alexander McMillan's.

	Top—Drift Pebbles and Sands—Coarse, massive Sandstones, with ledge of Conglomorate—Massive Sandstone	30 ft.	0 in.
(2)	Coal, good, free from slate (S. 30, T. 18, R. 8, W.)	1 "	2 "
	Sandstone, partly massive, partly laminated	60 "	0 "
	Blue slaty sandstone	20 "	0 "
	Gritty slate with fossils	4 "	0 "
	Blue slate with fossils	0 "	4 "
(1)	Coal	0 "	3 "
	Slate	0 "	½ "
	Coal	0 "	2 "
	Parting	—	—
	Coal	0 "	4 "
	Parting	0 "	¼ "
	Coal	0 "	3 "
	Black slate	0 "	2 "
	Curly, bottom slate	2 "	6 "
	Coarse, massive sandstone, forming the rock of the Squaw Shoals to level of river at Crowder's Shoals	90 "	0 "

Analyses are given below of the coals from both these seams, samples taken from several localities.

	1	2	3	4
Specific Gravity	1.280	1.317	1.329	1.282
Sulphur	.801	.608	.835	.798
Moisture	2.514	2.179	.778	2.391
Volatile Matter	32.093	32.855	33.271	33.865
Fixed Carbon	61.886	59.820	61.082	59.069
Ash	3.507	5.146	4.869	4.675
	100.000	100.000	100.000	100.000

No. 1. from S. 30, T. 18, R. 8, W., upper seam (2) of section given above.

No. 2 from S. 14, T. 19, R. 9, W., Prince Christian's, upper seam (2) of section given above.

No. 3 from S. 8, T. 19, R. 8, W., Panther Branch, lower seam (1) of section given above.

No. 4 from S. 32, T. 18, R. 8, W., Alex. McMillam's lower seam (1) of section given above.

Section 2. *From the foot of Sguaw Shoals to the Mulberry and Locust Fork of the Black Warrior.*

Distance 21.5 *miles—Difference of Elevation* 53 *feet.*

The coal beds that would be made accessible along this section of the river are described in the following details:

On the eastern side of the river, along Indian and White Oak Creeks, in sections 25 and 36 of Township 18, Range 8, West, three seams are known of which the subjoined measurements have been made.

Section on Lick Branch of Indian Creek.

Slaty sandstone roof.

COAL, cubical blocks	1 ft.	1 in.
Slate	4 "	6 "
COAL	0 "	3 "
State	0 "	6 "
COAL	1 "	0 "

Slate bottom.

275 feet above this seam is another seam in Farley's Spring the thickness of which is 12 inches.

On a branch of White Oak Creek, are outcrops of coal shows the following section.

Gritty, fossiliferous slate	1 ft.	0 in.
COAL	0 "	1 "
Slate	0 "	1/4 "
COAL	0 "	4 "
Parting.		
COAL	0 "	4 "
Slate	0 "	1/4 "
COAL	0 "	1 "
Slate	0 "	2 "
COAL	0 "	1 1/2 "
Bottom slate	0 "	6 "

Curly slaty sandstone with fossils at bottom of outcrop. Forty or fifty feet below this, in the bed of White Oak Creek, there is another seam from which coal has been mined.

From the above we get the following:

General Section of the Coal Measures on Indian Creek and Vicinity.

	Coal Measures with Capping of Pebbles	75 ft.	0 in.		
(3)	COAL (Farley's Springs)	1 "	0 "		
	Measures (Sandstones, &c.)	225 "	0 "		
(2)	COAL, (on branch of White Oak Creek)	1 "	1 1/2 "		
	Sandstones, etc	40–50 "	0 "		
(1)	COAL (on Lick Branch and White Oak Creek),				
	Upper Bench	1 "	1 "	}	2 ft.
	Lower Bench	1 "	3 "	}	4 in.

Near the river on the northwestern side, no coal outcrops have been observed between Blue Creek and Short Creek, a distance of twelve or fifteen miles.

On the opposite side, in sections 2 and 13 of township 18, R. 7, W., and in S. 36, T. 17, R. 7, W., and in S. 30, T. 17, R. 6, W., are out crops of a very good seam of coal which has been worked and the coal boated down to Mobile.

A few sections will give a correct idea of the character of this seam.

Section in S. 35, T. 17, R. 7, W., Heard's Shoals.

Blue gritty slate roof with fossils.		
COAL, good cubical blocks	0 ft.	4 in.
Clay slate, surface stained with iron oxide containing iron concretions	0 "	10 "
COAL	0 "	6 "
Mother of coal parting	0 "	¼ "
COAL	0 "	5 "
Mother of coal parting	0 "	¼ "
COAL as for as seen, (bottom not reached)	1 "	[illegible] "

On *Cedar Branch*, S. 13, T. 18, R. 7, W., we have the following section:

Slaty sandstone roof.		
COAL, good, cubical blocks	0 "	9 "
Slate	1 "	0 "
COAL, good, bottom not seen, (reported	2 "	0 "

In *Coal Cave Hollow*, S. 3, T. 17, R. 6, W., the section is as follows:

Slaty sandstone, with several hard layers	20 ft.	0 "
Blue gritty slate with fossils	1 "	6 "
COAL, good, cubical blocks	0 "	4 "
Dark clay slate	0 "	6 "
COAL, good, containing near tops ¼ inch. of pyrites	0 "	10 "
Slate parting, with flakes of pyrites	0 "	¼ "
COAL, good, rather soft	0 "	4 "
Mother of coal parting	0 "	¼ "
COAL, good, bottom not seen (reported)	2 "	0 "

On Valley Creek near the Weaver Mill in S. 36, T. 17, R. 7, W., are the old Frierson Coal Mines, at which mining has been conducted in a systematic way, and upon a large scale. The coal was all boated down the river during the winter months.

This seam has the following composition as shown by the subjoined analysis of a sample from *Coal Cave Hollow*. Probably the seams at Heard's Shoals, on Cedar Branch and at the Frierson Works are same as this.

Coal Cave Hollow.

Specific Gravity	1.330
Sulphur	1.945
Moisture	1.258
Volatile Matter	26.253
Fixed Carbon	59.896
Ash	12.594
	100.000

This brings us to the vicinity of the Fork Shoals, where many outcrops of coal have been observed and measured.

On the northwestern side of the river, in sections 23, 24, 25 and 26, in T. 17, R.7, W., on Short and Friley's Creeks, three seams are known, of which I give the sections below. The two lower seams are separated by 15 feet of slates and sandstones. One of these is probably the same as that measured at Heard's Shoals, Coal Cave Hollow, &c., above. The upper seam is separated from the lower ones by 100 feet or more of sandstones.

On Short Creek near the river, in the N. E. ¼ of N. W., ¼ of S. 26, T. 17, R. 7, W., on Mrs. Robinson's land, the two lower seams are exposed and afford the following sections:

	Top slaty sandstone.		
	Hard, compact, sandstone	0 ft.	10 in.
	Slaty sandstone, bluish below	10 "	0 "
	Bluish gritty slate	1 "	0 "
(2)	COAL, variable in thickness	0 "	3 to 22 in.
	Fossiliferous slate, with Sigillaria	2 "	0 in.
	Dark slaty sandstone, micaceous	12 "	0 "
(1)	COAL, at Level of Warrior River	1 "	10 "

On Friley's Creek, near the river, S. W. ¼ of N. W. ¼ of S. 24, T. 17, R. 7, W., on John Richardson's land, one of these lower seams gives the following section :

Gray sandstone, part massive, part laminated, some, with false bedding—at least	20 ft.	0 in.
COAL, good	0 "	$4\frac{1}{2}$ "
Hard, compact slate	0 "	8 "
COAL, good	1 "	$1\frac{1}{2}$ "
Hard, compact slate, with Sigillaria	1 "	0 "
Slaty Sandstone		

The same seam exposed on Thomas' land, near by, in S. E. corner of S. 23, T. 17, R. 7, W., was measured, with the following results:

Slaty Sandstone top.		
COAL	0 ft.	5 in.
Hard, blue colored slate	1 "	4 "
COAL	1 "	6 "
Hard bottom slate.		

Near Asbury Snow's spring, in the immediate vicinity of the Fork Shoals, the following measurements were taken, probably of the same seam:

COAL	0 ft.	4 in.
Slate	0 "	4 "
COAL, as far as seen	1 "	9 "

Analyses of the coal from this seam show the following composition:

	1	2	3
Specific Gravity	1.268	1.280	1.336
Sulphur	1.131	1.506	.722
Moisture	1.475	1.442	3.560
Volatile Matter	34.271	27.211	26.566
Fixed Carbon	59.128	66.000	64.288
Ash	5.126	5.347	5.646
	100.000	100.000	100.000

No. 1, From John Richardson's land on Friley's Creek, locality given above.

No. 2, From Thomas' land on Friley's Creek, locality given above.

No. 3, From Mrs. Robinson's lower bed, N. E. corner of N. W. ¼ of S. 26, T. 17, R. 7, W.

The lowest of the three seams mentioned is exposed below the water level in the river at the Fork Shoals, from which place it has been raised and boated down the river to Mobile. The uppermost of the three seams has a thickness varying from fifteen to twenty-two inches, as will be seen from the subjoined measurements. It is exposed in many places, at an average height of 100 to 125 feet above the level of Warrior River.

At the Fork Shoals, this seam is exposed in the Bluff, on the eastern bank of the river, where the following measurements were taken:

Laminated Sandstone	20	ft.	0	in.
COAL, good, red on joint surfaces	0	"	3	"
Soft Slate	0	"	$1\frac{1}{4}$	"
COAL, with cubical fracture, red on surface	1	"	6	"
Slaty Sandstone.				

Near John Richardson's house in N. W. of N. E. of S. 24, T 17, R 7, W., this seam has been measured in two places, with the following results:

Flaggy Sandstones	10	ft.	0	in.
Slaty	3	"	0	"
COAL, cubical blocks	0	"	4	"
Fossiliferous Slate	0	"	2	"
COAL	1	"	6	"
Bottom slate.				

Slaty Sandstone top.				
Gritty slate	1	ft.	0	in.
COAL	0	"	2	"
Slate	0	"	3	"
COAL, red joint surfaces	1	"	7	"
Slaty sandstone bottom.				

In this immediate vicinity, near Mrs. Taylor's house, the same seam outcrops, and exhibits similar characters to those above given.

On Short Creek (S. W. ¼ S. 23, T. 17, R. 7,) on Mrs. Robinson's land, upper bed, at an elevation of 135 feet above

the level of the river, a section, probably of this same seam, was made, with the following results:

Blue, gritty slate above.			
COAL, red and rusty in color on surface	0 ft.	11	in.
Slate	0 "	5½	"
COAL, very red on surface	0 "	3	"
Bottom, slate, as far as seen.			

The character of the coal from this seam may be seen from the following analyses made from samples taken from the outcrop at the Fork Shoals (No. 1), and near Mr. John Richardson's house (No. 2).

	No. 1	No. 2
Specific Gravity	1.325	1.310
Sulphur	.793	1.076
Moisture	4.976	1.398
Volatile Matter	27.169	30.647
Fixed Carbon	62.135	62.183
Ash	5.720	5.772
	100.000	100.000

From these data a section of the Coal Measures in the vicinity of the Fork Shoals has been constructed, to show more clearly the relative position of these seams:

Section of the Coal Measures near Fork Shoals:

	Laminated Sandstone	20 ft.	0	in.
(3)	COAL, upper seam	2 "	0	"
	Slaty Sandstones, sometimes laminated, becoming massive in places	100 "	0	"
	Bluish gritty slate	1 "	0	"
(2)	COAL, variable thickness ..... 3 in. to	1 "	10	"
	Fossiliferous slate, with Sigillaria	2 "	0	"
	Dark, slaty sandstone, micaceous	12 "	0	"
(1)	COAL, at bed of river ..... 1 ft. 10 in. to	2 "	0	"

Seam No. 1 is seen at Richardson's, on Friley's Creek; on Thomas' land, at Asbury Snow's spring; at Mrs. Robinson's, (together with No. 2), and in the river at the Fork. No. 3 outcrops in the Bluff, at the Fork, near Mrs. Taylor's

house, near John Richardson's, and on Mrs. Robinson's land on Short Creek

In this connection may with propriety be noticed occurrences of coal on Valley Creek, near Toadvine, S. 10, T. 18, R. 6, W., and in Sec. 11 of same township and range. Coal is found here in the bed of Valley Creek for a distance of two miles, and it appears there are two distinct seams, the upper one being of better quality, and reported to be about three feet in thickness. Before the construction of railroads through parts of the Coal Measures, many boat loads of coal were raised from these seams, and floated down to Mobile. With a navigable river below, these beds will doubtless again be extensively worked.

I shall also here speak of two occurrences of coal on the Little River (although they lie outside of the region of the present survey) for the reason that one (on Coal Creek) will be easily reached, whenever the Fork Shoals are made navigable; and the other (at Calvary Williams'), whilst it may not be made directly available by the improvement of the Warrior River, will doubtless be mined and floated, in high water, down the Little River to the Fork, if indeed the Little River itself should not be improved for the purpose of reaching this valuable seam

Coal Creek is well known in this locality from the circumstance that coal is exposed in the bed of the Creek almost continuously, from near its mouth to the head waters, a distance of three miles or more. It seems probable that there are three seams, but from lack of an opportunity of getting a full section of the lowermost outcrop, we can be certain of only two. Within a quarter of a mile of the mouth of the creek is the first outcrop. The upper part of this seam (1 foot thick as far as seen) appears in the bed of the Creek in several places. The coal is bright and hard. Near the south line of S. 26, T. 16, R. 6, W., a second bed is exposed at which the following section was obtained :

Sandstone roof.	
COAL	1 foot 0 inches
Clay parting	0 " ¾ "
COAL	2 " 6 "
Sandstone bottom.	

An average sample of this coal shows the following composition:

Specific gravity	1.351
Sulphur	1.525
Moisture	1.850
Volatile matter	27.561
Fixed carbon	61.696
Ash	8.893
	100.000

Near the Landtrip old place, near the head waters of the Creek, another seam is exposed, the lower part of which could not be seen. The section, as far as could be made, was as follows:

Sandstone roof.	
COAL	0 feet 7 inches
Slate	0 " ¾ "
COAL	0 " 4 "
Slate	0 " ½ "
COAL, bottom not seen, visible	2 " 0 "

This coal is also of good quality and the seam is said to be over three feet in thickness.

At the mouth of the Village Creek, on land belonging to Calvary Williams, in S. 28, T. 16, R. 5, W., and in northeast quarter of section 33, there is an outcrop of coal of exceptional thickness. The measurements given below show the character and extent of these beds, which are distributed in two groups:

	Shale roof.				
UPPER GROUP.	Coal (4)	1 foot	3	in.	
	Clay	0 "	2	"	
	Coal (3)	0 "	4	"	
	Slate	0 "	3½	"	
	Coal (2)	2 "	3	"	
	Slate	0 "	10	"	
	Coal (4)	4 "	0	"	1 ft. 6 in. showing above water level.
	Gritty slates	10 "	0	"	
LOWER GROUP.	COAL, main bench, 5 to 6 feet.				

The analyses which follow of average samples of the coal from the lowest seam of the Upper Group (No. 1), and from the main bench of the Lower Group (No. 2), show the composition of this coal:

	No. 1	No. 2
Specific gravity	1.391	1.312
Sulphur	.521	.604
Moisture	4.175	1.525
Volatile matter	22.415	26.170
Fixed carbon	62.492	66.020
Ash	10.928	6.285
	100.000	100.000

The lower or main bench appears to be quite free from shale or slate; it is hard and does not crumble upon exposure to the weather, cakes very little when heated, making it probable that it can be used raw in the furnace. The coal from the upper series of beds is also a firm coal which, though exposed for years upon the bank of the river, has not crumbled perceptibly.

The strike of the measures here is N. 25° E. and dip S 65° E. at the rate of 3½°.

It is not yet ascertained where these seams belong in the general section of the Basin, nor over what extent of country they are to be found, nor to what distance (beyond a mile or two) the beds retain their exceptional thickness.

Section 3. *From the Locust and Mulberry Fork of the Black Warrior, to the Fork of the Sipsey and Mulberry at Old Warrior Town. Distance* 47.75 *miles. Difference of elevation* 50 *feet.*

The material advantages to be gained by opening this part of the river, are presented roughly in the following details, by which it will be seen that whilst the fall and consequently the difficulties to be overcome, are slight, the length of navigable river gained would be about half that embraced in the

present survey, and the number and value of the Coal seams thus made accessible, will in no way fall below those already described.

Above the Fork Shoals to the mouth of Lost Creek, appear to be few outcrops of coal, except where in the vicinity of Dr. Snow's landing, one of the Lower, and near Mr. John Richardson's and Mrs. Taylor's houses, the Upper of the Fork Shoals seams described above, are found in most of the branches flowing into the river.

On the eastern side of the river, coal is rare near the Fork. It is a noticeable fact that whilst on Coal Creek, the water runs for two or three miles over coal beds, on Prescotts', which is the next creek, flowing into the river only a few miles above Coal Creek, there is no known occurrence of coal.

Between Wilmington P. O., in S. W. of S. 1, T. 17, R. 7, W., and Lost Creek, there is a high ridge elevated 425 to 450 feet above the river level. This ridge divides the waters of Lost Creek from those of Friley's and Shoal Creeks flowing into the Warrior below the Fork. This ridge is noticeable for having in same parts, a capping of pebbles of Orange Sand or Straitfied Drift age.

In the vicinity of Lost Creek, between the Warrior River and Wolf Creek, a seam of coal has been examined in numerous localities and the fact of its occurrence for several miles along the river has been established.

Thus, on Falls Branch, near the ford of the Jonesboro road, in S. 22, T. 16, R. 7, W., the following section was obtained:

Slaty sandstone.		
COAL, good, hard	1 ft.	0 in.
Black shale	0 "	3 "
COAL	0 "	3 "
Dark gray slate	0 "	6 "
COAL, soft, bony	1 "	0 "
Hard slate bottom.		

Above this bed there are at least 100 feet of thinly lami-

nated sandstone, with some ledges of heavy-bedded rock. The dip of the rocks where the above section was made is S. 25° or 30° E., rate of dip 2½°, but this is probably on account of an undulation in the strata, since the prevailing dip is west.

Below the ford, on the bank of Lost Creek, is a shaft, from which some coal was raised years ago.

On Fanny's Branch, which empties into Lost Creek, near its mouth, the same seam may be seen in several places, e g. in S. W. corner of N. E. quarter of S. 23, T. 16, R. 7. W., and higher up near the middle of N. & S. line, between the N. E. & N. W. quarters of S. 23. The dip here also is S. 25° or 30° E., and rate of dip 3°.

On the east side of the river, near the S. W. corner of S. 26. T. 16, R. 7, W., in the Brake bend, the same coal is exposed in a small branch, a quarter of a mile from the river. As will be seen by the sections below, the seam is the same as that on Fanny's and Falls' Branches. though thicker and better.

Section on East side of River, just above mouth of Lost Creek.

Bluish, slaty sandstone roof.		
COAL, good hard	1 ft.	0 in.
Black shale	0 "	2 "
COAL, good	0 "	8 "
Slate parting	0 "	¼ "
COAL	0 "	1½ "
Parting	0 "	⅛ "
COAL, good	0 "	8 "
Soft, whitish clay slate	0 "	2 "
COAL, soft	0 "	1½ "
Slate	0 "	2½ "
COAL, good	0 "	1½ "
Bottom, slate, with fossils, as far as seen	1 "	0 "

In the upper part of the Brake bend and near foot of the Franklin shoals, S. 30, T. 16, R. 6, W., the same seam was measured again, with the following results :

Gritty Slate and Sandstone roof		
COAL, good, hard	0 ft.	8 in.
Black shale,	0 "	$1\frac{1}{2}$ "
COAL, good	0 "	4 "
Parting slrte	0 "	$\frac{3}{4}$ "
COAL	0 "	4 "
Parting slate	0 "	1 "
COAL	0 "	11 "
Grayish, hard slate, with fossils, as far as seen	0 "	10 "

By comparison of these sections, it will be seen that the seam varies much in thickness, and in quality of the coal and amount of slate. In some localities it could be worked with profit. On the west side of the river, the seam has been regularly mined, at the Van Hoose mine, where it is elevated at least 25 feet above the water level.

The analysis given below of this coal, from Brake Bend, S. 24, T. 16, R. 7, W., will show its character :

Specific gravity	1.339
Sulphur	1.105
Moisture	4.535
Volatile matter	26.407
Fixed Cardon	56.890
Ash	12.168
	100.000

In the bank of that part of the river running between the Franklin and the Payne bends, in the S. W. quarter of S. 19, T. 16, R. 6, there is a stratum of dark-colored fossiliferous limestone, at least three feet in thickness; this rock is known also at the mouth of Bluff creek, opposite Thompson Bend. So far as the writer knows, this is the first occurrence yet announced of limestone in the Alabama Coal Measures.

A Section of Measures at Franklin's Bend is

Stratified sandstone—top of bluff	100 ft.
Dark, fossiliferous limestone, at least	3 "
Measures, sandstones, &c	12 "
COAL, thickness not ascertained	
Sandstone and other measures	20 "
COAL, at surface of water in river, thickness not ascertained	

The seam, of which sections were given above, occurring near the mouth of Lost Creek, and in Brake Plantation, is probably *one* of the above section.

At this point I shall make a slight digression, for the purpose of describing certain occurrences of coal at a distance from the river, and principally along the course of Lost Creek. With the opening of the river, by means of locks and dams, all these coal localities upon Lost Creek and its tributaries, will be easily accessible.

In the southwestern part of T. 15, R. 7, W., upon tributaries of Baker's Creek and Lost Creek, a very good seam of coal has been exposed. The following measured section will show the character of the seam.

On Mrs. Bailey's land, S. E. of S. E· of S. 20, T. 15, R. 7, W., on a branch of Bryant's Creek, the seam is as given below:

Massive sandstone	6	ft.	0	in.
Slaty roof	8	"	0	"
COAL, good	1	"	6	"
Black shale	0	"	1½	"
COAL, bony	0	"	9	"
Parting	0	"	¼	"
COAL, good	0	"	3	"
" bony	0	"	4¼	"
Slate bottom.				

The bony part of this outcrop is worse than the same part of the seam at any of the other localities visited.

In the other localities, it was found impossible to get complete measured sections of the outcrops; the thickness of the seam varied from three to three and a half feet, as given below. In Nick Key's field, on Double Falls Branch, S. 34, T. 15, R 7, the thickness is about three feet, the coal of a better quality than that at Mrs. Bailey's; it works well in shops, and stands shipment and the weather without crumbling.

In S. W. corner of S. 26, T. 15, R. 7, on Tom Bradley's

land, the same seam outcrops on Helm,s prong of Baker's Creek; thickness about 3 feet 6 inches. The coal is hard and bright, and has been much used as a shop coal, for which purpose it is well suited. In sections 34 and 35, adjoining, the same coal is known, so also, in S. 26, near Mt. Zion church and school house spring. At this latter place the coal is somewhat too bony, and is not considered so good. In the southeast corner of S. 23, near the site of the Burnt Meeting House, on John Garner's land, the same seam may again be seen; from this locality the coal enjoys a fine reputation as a smith's coal.

The subjoined analyses exhibit the character of the coal:

	1	2	3
Specific Gravity	1.278	1.339	1.416
Sulphur	0.690	0.603	1.236
Moisture	2.702	5.715	1.533
Volatile Matter	29.564	28.095	30.405
Fixed Carbon	64.818	62.612	51.962
Ash	2.916	3.578	16.100
	100.000	100.000	100.000

No. 1. Hard, lustrous coal free from smut—Tom Bradley's.

No. 2. Better part, but dull, friable from long exposure—Mrs. Bailey's.

No. 3. Bony part—Mrs. Bailey's.

These are all outcrops of probably the same seam. It has many points of resemblance to the Mt. Carmel seam to be described below. It is hard and bright, and will stand storing and shipping.

At Lost Creek, at the crossing of the Old Baltimore Road, near Williams' Mill, the following section of the strata has been obtained, which will explain the relations of the several coal seams in this vicinity.

Section on Old Baltimore Road, near Williams' Mill on Lost Creek.

Slaty Sandstone, top of hill

(3) COAL, thickness not known.

	Flaggy sandstones	25 feet.		
(2)	COAL, bony at top, hard and bright	3 "	6 inches.	
	Flaggy sandstones	30 "	0 "	
	Heavy bedded sandstones	2 "	0 "	
	Flaggy sandstones	5 "	0 "	
	Heavy bedded sandstones	30 "	0 "	
(1)	COAL	0 "	6 "	
	Slaty sandstones to water level	3 "	0 "	

The coal No. 3 was seen only in dirty outcrops along the road in several places. Coal No, 2 is seen in a small ravine near the Old Baltimore Road, one hundred yards or more south of the mill. It is hard and somewhat bony at top, resembling, in many respects, the coal in the seam described above as outcropping at Tom Bradley's, Mrs. Bailey's and other localities. The coal No. 1 is a thin seam between sandstones and exposed near the water level at the mill.

On the west side of Lost Creek, near the Baltimore ford, and in the fork between Cane and Lost Creeks, on Mr. David Cobb's land, coal has been taken in large quantities from the bed of Cane Creek. This is in the S. W. corner of S. E. "Forty" of the N. W. ¼ of S. 5, T. 16, R. 7, W. It is a very hard, bright coal, with sufficient bony coal to make it a fine stocking coal, but not enough to injure it as a fuel. The thickness could not be measured, as the bed was below the water level in Cane Creek, the coal, however, has many points of resemblance to the Bradley coal on the opposite side of the creek.

An analysis of this coal shows the following composition in 100 parts:

Specific Gravity	1.310
Sulphur	.728
Moisture	2.261
Volatile Matter	33.782
Fixed Carbon	57.002
Ash	6.955
	100.000

A bright, clean laminated coal, breaking into regular fragments.

Higher up Lost Creek, at Holly Grove, there are two seams, with about 20 feet of slaty sandstone between them.

Section in Holly Grove Neighborhood:

	Slaty sandstones		
(2)	COAL, about	1 ft.	0 in.
	Slaty sandstones	20 "	0 "
(1)	Coal	2 "	6 "
	Slate.		

The coal No. 1 was examined at several localities on Lost Creek.

At Guttery's Cave Hole we get the following section:

Sandstone ledge.		
Bluish, gritty slate—the lower foot or two more clayey and with fossils and nodules of clay ironstones	1 ft.	0 in.
COAL, rather bony	0 "	3 "
COAL, hard, brighter	2 "	1 "
Slate bottom.		

This is in N. E. $\frac{1}{4}$ of S. 18, T. 14, R. 8, W., and the same seam is exposed everywhere along the banks of the creek in this vicinity.

An average sample of the coal from the locality above given, was analyzed with the following result:

Specific Gravity	1.365
Sulphur	.687
Moisture	3.332
Volatile Matter	30.683
Fixed Carbon	52.762
Ash	13.223
	1.00.000

The upper thin bed was not particularly examined.

A few miles east of Holly Grove, on the Jasper Road, the following section of the Measures was made.

Section $8\frac{1}{2}$ miles W. of Jasper near Lost Creek.

	Slaty sandstone	15 ft.	0 in.
(3)	COAL, approximated	1 "	6 "

	Gritty slate with clay ironstone	20 ft.	0 in.
(2)	COAL	2 "	0 "
	Under clay	2 "	0 "
	Gritty slate with clay ironstone	3 "	0 "
(1)	Coal	0 "	6 "
	Siliceous curly slate	2 "	6 "

No opportunity presented itself for examining in detail either of these seams; but on Lost Creek, just below the mouth of Burton's Creek, near center of S. 19, T. 14, R. 8, W., a mile or more from the locality just given above—is a well known coal bed called the *Baker Bed*. This bed lies below the water level in the creek and it was not possible to get a measurement, but a large amount of good coal has been raised here. Near this is another seam about twenty inches thick and the following measurements will show the relations between the two.

Section of Baker Beds on Lost Creek, below Mouth of Burton's Creek, Walker Co.

	Slaty sandstones, with hard ledges	2 ft.	0 in.
	Clay slates, roof	1 "	3 "
(2)	COAL, bony on top, good below	1 "	8 "
	Fire clay	0 "	2 "
	Gritty slate	2 "	0 "
	Slaty sandstone with hard ledges	7 "	0 "
(1)	COAL, good, hard, in bed of creek, reported to be	3 "	0 "

The following analyses made from specimens of the lower bed and from an *average sample* of the upper bed will show the character of the coal:

No. 1. Sample from Baker's upper bed—Lost Cr. Walker Co.
No. 2. Specimen " " lower " " " " "

	1	2
Specific Gravity	1.324	1.285
Sulphur	0.695	1.331
Moisture	(.355	2.578
Volatile Matter	31.086	35,164
Fixed Carbon	60.665	59 348
Ash	1.894	2.910
	100.000	100.000

No. 1 shows a considerable amount of weathering, still both these coals show excellent qualities; they are both hard and compact, and will stand any amount of handling, and at the same time the percentage of ash is quite small in each case. Near the head waters of Burton's Creek, which flows into Lost Creek in this vicinity, is a thick seam of coal, known as the *Townley Bed.* Its outcrops occur in several places in S. 34, T. 13, R. 8, W. The bed varies considerably in thickness, so that it is at present hardly possible to give the average. The following section was made from actual measurement.s, not at the thickest place:

Section of the Townley bed.

	Slaty sandstone	10	ft.	0	in.
	Blue clay slate with many fossils	2	"	0	"
	Soft parting shales	0	"	1	"
Upper Bench	Bony coal	0	"	2	"
	COAL, good but somewhat bony	1	"	4	"
	Mother of coal parting	0	"	½	"
	COAL, good, best below	2	"	2	"
	Hard black clay slate, with fossils	0	"	11	"
Lower Bench	COAL, best in bed	2	"	0	"
	Black fossiliferous slate	2	"	0	"

I present here two analyses of coal from this bed: No. 1, from above the hard black clay slate, and No. 2, from below it. If only the lower part of the upper bench, just above the clay slate, were mined, it would be much better, the analysis is made from coal from the whole thickness.

	1	2
Specific Gravity	1.450	1.310
Sulphur	1.744	0.710
Moisture	2.960	3.007
Volatile Matter	26.162	29.084
Fixed Carbon	44.516	63.352
Ash	26.362	4.557
	100,000	100.000

For local use, only the lower bench, No. 2, has been much mined, and this, the analysis shows to be an excellent coal.

Higher up Lost Creek and on the upper waters of Mill

Creek, an eastern tributary of Lost Creek, are several coal beds of which I am able to give an approximate general section.

Thus, near Kansas post-office and on Tim Burton's land on the banks of Lost Creek, near the southeast corner of S. 30, T. 13, R. 9, W., there are three distinct beds whose relations are shown in the following general section:

Approximate Section of the Coal Measures near Kansas Post-office Walker County.

	Sandstone, &c.		17 ft.	0 in.
(3)	COAL, cut in Burton's well		4 "	6 "
	Heavy bedded sandstone, &c		60 "	0 "
(2)	COAL very good	1 ft. to	1 "	6 "
	Slaty sandstone		10 "	0 "
(1)	COAL, good, in bed of Lost Creek (reported.)		3 "	0 "

The bed No. 3 is cut in Mr. Burton's well, and whilst it is somewhat bony it is still a very fair coal. The seam is probably the same as the Jaggers bed described below. The same seam has been cut in another well half a mile from Mr. Burton's.

On Lost Creek, south of Kansas post-office, coal is found in the bed of the creek for a distance of a mile or more. This coal has the reputation of being a fine shop coal, and from its appearance, this reputation is well deserved. A thorough examination of this bed could not be made for the reason that it lies mostly below the water level.

Specimens from this lowest seam, No. 1 of above section, have been analyzed with the following resutl:

Specific Gravity	1.315
Sulphur	.586
Moisture	2.606
Volatile Matter	34.110
Fixed Carbon	56.628
Ash	6.656
	100.000

About 10 feet above this bed, and separated from it by

slaty sandstones, is another coal seam. This bed, No. 2 of above section, being thin, was not sampled for analysis, but a section was made of the enclosing rocks as follows:

Section of bed (2) on Lost Creek, near Kansas Post-office, Walker County.

Whitish slaty sandstones.		
Black slate	0 ft.	1 in.
COAL, very good	1 "	0 "
Clay slate bottom	2 "	0 "

On Dr. Miller's land, near the center of S. 33, T. 13, R. 9, W., a seam of coal reported to be two feet in thickness has been opened and worked to some extent. The coal is good—splits easily.

On Mill Creek, just below the mouth of Jagger's Creek, near Miller's Mill, a seam of coal makes its appearance in the bed of the creek. This seam is at least 18 inches thick, and is very favorably known as a coal suitable for blacksmithing.

Above this bed lie 60 feet or more of tolerably heavy-bedded sandstones, and over these another seam, known to fame as the Jaggers seam. This Jagger's seam is exposed in the branches on both sides of Mill Creek and at about an elevation of 60 feet, above the same. It was measured at the school house on Jagger's Creek, S. 11, T. 13, R. 10, W. with following result:

Section of Jaggers Coal.

Whitish slaty sandstone roof.		
Fire clay	0 ft.	2 in.
Soft, black bituminous shale	0 "	7 "
Bituminous shale, whitish when exposed	0 "	6 "
Bony coal bad	0 "	9 "
Parting	0 "	1/4 "
Bony coal	1 "	0 "
Parting	0 "	1/4 "
COAL, somewhat bony but fair	1 "	8 "
COAL, good	0 "	7 "
COAL, bony	0 "	2 "
Black cooly shale	0 "	2 "
Sandstone with irregular surface.		

This coal bed undulates considerably, and it is sometimes entirely above the level of the water in the branch and sometimes below it; for this reason, probably, the most exaggerated statements have often been made about the thickness of this bed. The measurements above given, however, are correct.

The following analysis will show the character of the better part of the coal from this seam:

Specific Gravity	1.233
Sulphur	.574
Moisture	3.091
Volatie Matter	29.044
Fixed Carbon	56.537
Ash	11.328
	100.000

To return to the river. Along Baker's Creek and the river near its mouth, the coal seam described at Tom Bradley's is exposed in several localities, but the next well known locality for coal extends from near the mouth of Burnt Cane Cr., in Shepard's Bend, up the river to beyond the mouth of Big Cane Creek. In all this region, on both sides of the river, there are several seams of coal easily accessible. In many places the lower seam has been extensively worked. The relations of these seams may be seen from the following considerations. Near Mr. Wm. Davis', S. 15, T. 15, R. 6, W., at depth of 32 feet from the surface, a seam of coal 2½ ft. thick was cut in his well. In the lower part of his plantation, and 50 to 60 feet above water level in the river, there is another seam; and at or below the water level in this whole neighborhood is still another, so that there are at least two seams, and if that in Davis' well and in the lower part of his plantation are not the same, there are three. I shall not attempt to give the stratigraphical relation of the seams to be described below, for the reason that sufficient examina-

tions have not yet been made to give certainty on these points. I shall therefore describe the occurrences of coal, with the remark that they are probably to be referred to two, or at most three horizons.

On Burnt Cane Creek, in S. W. corner of S. 25, T. 15, R. 6, W., on Alex. M. Stevens' land, a thick seam gives the following section:

Section of Beechy Hollow Seam.

COAL, good	0 ft.	8	in.	Upper B., 3 ft. 5½ in.
Parting	0 "	¼	"	
COAL, good	0 "	3½	"	
Parting				
COAL, good	1 "	7½	"	
Black slate	0 "	¾	"	
COAL	0 "	6	"	
Slate	0 "	2	"	
COAL	0 "	1½	"	
Slate	0 "	9	"	
COAL	0 "	6	"	Lower B., 1 ft. 4 in.
Bony COAL	0 "	1	"	
COAL	0 "	9	"	

An analysis of an average sample, much weathered, including coal from both benches of this seam, shows the following composition in 100 parts:

Specific gravity	1.439
Sulphur	.527
Moisture	6.952
Volatile matter	27.065
Fixed carbon	55.640
Ash	10.343
	100.000

In S. 30, T. 15, R. 5, near Shulough P. O., an outcrop was examined of a coal seam apparently considerably higher than the Beechy Hollow Seam.

The section is as follows:

Heavy bedded sandstone roof.
COAL, excellent .... 1 ft. 8 in.
Slate bottom.

In the Jasper road near Shulough, by reason of an anticlinal fold in the strata, this seam outcrops in two places.

On Horse Creek, near its mouth, upper part of S. 26, T. 15, R. 6, are two seams separated by about 25 feet of strata. It may be that these two outcrops belong to the same seam, being displaced by a fold in the rocks; the analyses show a very close resemblance in the quality of the coal. The lower bed lies below the water level in Horse Creek; it has been much worked before the war, and was shipped to Mobile; at present the bed is entirely hidden from sight by rubbish. From some of the piles which have been lying exposed for 15 or 20 years, I selected samples for analysis which gave the following result:

Coal from the Bed of Horse Creek.

Specific gravity	1.335
Sulphur	.711
Moisture	1.848
Volatile matter	28.365
Fixed carbon	58.213
Ash	11.574
	100.000

On a little tributary of Horse Creek, and 25 feet in elevation above the preceding, is the Robinson Bed which was measured.

Section of Robinson Bed, on Horse Creek, Walker Co.

Bluish slaty sandstone	15 ft.	0 in.
Blue clay slate with fossils	1 "	6 "
COAL, good, a little bony on top	1 "	0 "
Black slate parting	0 "	1/8 "
COAL, good, hard, bright	0 "	10 "
Bluish slate parting	0 "	1/8 "
COAL, good, hard, bright	0 "	10 "
Black shale	0 "	1/2 "
COAL, good, hard	0 "	4 "
Clay slate bottom		
Measures down to Horse Creek Seam	25 "	

Analysis of two samples of Coal from Robinson's Bed, Horse Creek.

Specific gravity	1.371	1.364
Sulphur	0.580	0.599
Moisture	2.454	2.703
Volatile matter	27.007	26.600
Fixed carbon	57.650	56.367
Ash	12.989	14.330
	100.000	100.000

Higher up the river, near the mouth of Flat Creek, on Squire Jas. W. Davis' farm, one of these seams is again exposed, of which we get the following:

Section on Flat Creek, J. W. Davis'.

Slaty sandstones.	
Clay slate with fossil plants	2 ft.
COAL, all good and hard	2 "

An analysis of the upper 8 inches of this coal gives the following result:

Specific gravity	1.362
Sulphur	1.516
Moisture	1.674
Volatile matter	33.199
Fixed carbon	54.540
Ash	10.287
	100.000

At Mrs. Davis' House on Horse Creek, near the S. W. corner of S. 24, T. 15, R. 6, W., a seam of coal was cut through in a well 43 feet below the surface, and by aneroid measurements, it would seem that this bed is 40 feet above the Robinson bed on Horse Creek, so that we have the following:

Approximate General Section of Coal Measures on Horse Creek:

	Sandstone ,&c.	43 ft. 0 in.
(3)	COAL (struck in well)	3 " 6 "
	Measures	40 " 0 "
(2)	COAL, (Robinson Bed)	3 " 0 "
	Measures	25 " 0 "
(1)	COAL, (Horse Creek, Flat Creek)	2½ to 3 " 0 "

One or the other of the lower seams of the above section is laid bare in the bed of Horse Creek in numerous localities above Mrs. Davis' in sections 24 and 13.

On the opposite side of the river, the same seams occur near Davis' Ferry and Ford, and an approximate section of the measures there has been given.

On Frog Ague Creek, Big Cane Creek, and in the Baugh or Dent Bend, are outcrops of a fine seam of coal which we have called the Mt. Carmel seam. This is probably one of the lower seams of the Mrs. Davis or Horse Creek section.

The following sections will show the character of the Mt. Carmel Seam:

Section at Mt Carmel Church or Frog Ague Creek, S. 8, T. 15, R. 6, W., Walker Co.

Blue slaty sandstone	15 ft.	0	in.
Blue clay slate, with fossils	2 "	0	"
Bony COAL	0 "	1½	"
COAL, good, hard	2 "	3	"
Mother of coal, parting	0 "	1	"
COAL, good, hard	0 "	5	"
Slate	0 "	¼	"
COAL	0 "	1	"

On Big Cane Creek, in an adjoining section, is obtained the following:

Section on Big Cane Creek, S. 4, T. 15, R. 6, W., Walker Co.

Bluish slate, with many fossils, roof.			
COAL, good, very hard	2 ft.	6	in.
Parting	0 "	½	"
COAL	0 "	4	"
Black slate	1 "	0	"
Fire clay	0 "	2	"
Laminated sandstone.			

Both these sections show abort 34 inches of coal. The coal is very hard and bright, and will stand any amount of handling without crumbling. From its physical properties, therefore, it is exceedingly well adapted for shipping, and the analyses show that it is a very good coal.

	1	2
Specific Gravity	1.380	1.401
Sulphur	0.586	0.482
Moisture	2.213	3.799
Volatile Matter	28.987	26.217
Fixed Carbon	56.454	57.316
Ash	12.355	12.668
	100,000	100,000

No. 1, from Mt. Carmel Church.

No. 2, from Big Cane Creek.

The similarity in the composition of these coals with those from Horse Creek, on the other side of the river, would indicate that they are from the same bed, and the physical characters of the coal point to the same conclusion. As has been already said, however, the examinations have not been extended enough to give certainty on these points.

Above the mouth of Big Cane Creek to the Sipsey Fork, are several seams, the characters of which, and their relations to each other, will be sufficiently well seen in the details below.

Near Sanders' Ferry an outcrop of coal is seen on the Old Baltimore Road, where it crosses Blackwater Creek; on the other side of the river, an outcrop, probably of the same seam, may be seen by the roadside, 30 to 40 feet above the river, and another seam occurs in all this vicinity at or near the water level of the river.

Above Sanders' Ferry, in S. W. part of S. 20, T. 14, R. 5, W., in Mrs. Burton's field, is a seam about 2 feet in thickness, about 30 feet above the water level in the river. The same seam appears also near M. D. L. Sanders', on the opposite side of the river, and also at J. M. Phillips', in N. E. of S. 3, T. 15, R. 5, W., near Democrat.

The following analysis from *Mrs. Burton's upper bed* shows the character of this coal:

Specific Gravity	1.318
Sulphur	3.070
Moisture	2.052
Volatile Matter	38.078
Fixed Carbon	55.265
Ash	4.605
	100.000

Twenty-five or thirty feet below this is another seam, known as the Phillips and Cordell, or Phillips and Camak, seam, from the two firms which have mined the coal. The Phillips and Cordell Mine is on the south side of the river, opposite Mrs. Burton's bend, in the S. W. ¼ of S. 28, T. 14, R. 5, W., upon a small branch. The same coal has also been raised from the bed of the river, near the mouth of the Branch.

The same bed is also seen in Mrs. Burton's field (Lower bed), near the river, in S. 29, and on James Macbee's land, and on land belonging to his father, both in S. 21, and lastly, perhaps, at James Cole's Spring Branch, near the Fork, in S. 16, T. 14, R. 5. At the latter place the coal resembles very much the English Cannel Coal. As the seam at this point is 40 feet above the level of the river, it may not be the same as the Phillips and Cordell.

The following analyses are from samples taken at the several localities named above:

	1	2	3
Specific Gravity	1.290	1.263	1.268
Sulphur	.649	.988	.593
Moisture	3.098	1.700	4.047
Volatile Matter	34.552	36.228	34.193
Fixed Carbon	60.745	60.591	60.698
Ash	1.605	1.481	1.062
	100.000	100.000	100.000

No. 1, from Phillips and Cordell Mine.

No. 2, from James Cole's Spring Branch.

No. 3, from E. J. Phillips', near Old Warrior Town.

By these analyses it will be seen that this coal is of very great purity, and, in some respects, superior to any yet examined along the river.

On the road from Sanders' Ferry to Democrat, near the centre of S. 4, T. 15, R. 5, W., on Jim Hawthorne's land, is a fine seam of coal which is thought to be the Pratt seam. If this surmise is correct the importance of the discovery can not well be over-estimated. The seam is near the outcrop at J. M. Phillips' mentioned above, but the Pratt seam overlies the Phillips'. The thickness of this seam is reported to be 3½ to 4 feet. Two feet of the upper part has been examined, and from samples taken the following analysis has been made:

Coal from Jim Hawthorne's (Pratt Seam ?)

Specific Gravity	1.333
Sulphur	.516
Moisture	2.969
Volatile Matter	29.784
Fixed Carbon	60.598
Ash	6.649
	100.000

No other outcrop of this seam was observed, yet it is quite probable that it will be found much nearer the river.

For the sake of comparison, I subjoin an average of the analysis of the upper and lower benches of the Pratt seam near Birmingham:

Specific Gravity	1.300
Sulphur	.918
Moisture	1.501
Volatile Matter	31.485
Fixed Carbon	61.598
Ash	5.416
	100.000

For the purpose of showing the probable relations of seams which are found near the Sipsey Fork, I subjoin the following:

Section of the Coal Measures in the vicinity of Old Warrior Town, Walker County.

Surface.		
Slaty sandstones	35 ft.	0 in.
Hard, flaggy sandstones	10 "	0 "
Slaty sandstone, compactbeneath	65 "	0 "
(3) COAL, [Jim Hawthorne's] (Pratt seam?) ...3½ @	4 "	0 "
Flaggy sandstones	140 "	0 "
Sandstone, partly massive	55 "	0 "
(2) COAL, *Mrs. Burton's upper seam, Sanders, J. M. Phillips*	2 "	0 "
Sandstone, partly massive	30 "	0 "
(1) COAL, *Phillips & Cordell, Mrs. Burton's lower seam, Jim Cole's spring branch, Jas. Macbee's*	3 "	0 "
River level.		

In the preceding pages the general section of the Warrior Field, along the South and North R. R., and two or three analyses of coals have been reprinted from a previous report.

The convenience to the reader, and the greater completeness thus secured, will doubtless be sufficient justification for these few pages of reprint.

For convenience of reference, the coal analyses appearing above, in the body of the report, are here presented in tabular form.

TABLE SHOWING PROXIMATE COMPOSITION OF COALS—INCLUDING SULPHUR.

No.	LOCALITY.	ANALYST.	Specific Gravity.	Sulphur.	Moisture.	Volatile Combustible Matter.	Fixed Carbon.	Ash.
No. 1.	McLester Shaft, Tuskaloosa	H. McCalley	1.283	1.861	2.245	35.130	55.301	7.324
2.	Asylum Shaft, Tuskaloosa	“ “	1.397	1.867	1.892	32.011	55.364	10.733
3.	Mrs. S. M. Chambers' Mine, Tuskaloosa Co.	“ “	1.281	2.386	1.838	30.682	64.339	3.141
4.	Prude's Lower Mine, Tuscaloosa Co.	H. McCalley	1.327	0.626	5.426	31.952	59.455	3.167
5.	Goree Bed, University Seam, Tuskaloosa Co	H. McCalley	1.386	0.870	2.062	31.103	55.495	11.340
6.	University Mine, University Seam, Tuskaloosa Co.	J. B. Durrett	1.298	1.038	1.833	36.233	54.534	7.400
7.	Jim Mack's Branch, University Seam, Tuskalosa Co.	H. McCalley	1.393	0.765	7.285	28.989	54.522	9.204
8.	Manly Bed, Tuskaloosa Co	“ “	1.277	0.752	2.004	33.833	61.872	2.291
9.	“Block Coal” Seam, Tuskaloosa Co.	“ “	1.411	1.613	2.239	34.606	50.375	12.780
10.	Double Seam, Tuskaloosa Co	“ “	1.304	2.129	1.810	34.029	58.240	5.921
11.	James Beaver's Seam, Tuskaloosa Co	J. B. Durrett	1.311	0.660	2.513	31.977	60.033	5.477
12.	“Cannel” Coal (?) near Daniel's Creek, Tuskaloosa Co.	H. McCalley	1.348	2.752	0.830	36.207	48.319	14.644
13.	Upper Seam, S. 30, T. 18, R. 8, W., Tuskaloosa Co.	J. B. Durrett	1.280	0.811	2.514	32.093	61.886	3.507
14.	Near Prince Christian's, Tuskaloosa Co.	H. McCalley	1 317	0.608	2 179	32.855	59.820	5.146
15.	On Panther Branch, Tuskaloosa Co	J. B. Durrett	1.329	8.835	0.778	33 271	61.082	4.869
16.	Near Alexander McMillan's, Tuskaloosa Co.	J. B. Durrett	1.282	0.798	2.391	33.865	59.069	4.675
17.	Coal Cave Hollow, Jefferson Co.	H. McCalley	1.330	1.945	1.258	26.253	59.869	12.593
18.	John Richardson's, on Friley's Creek, Walker Co.	J. B. Durrett	1 268	1.131	1.475	34.271	59.128	5.126
19.	Thomas' Bed, near Friley's Creek, Walker Co.	H. McCalley	1.280	1.506	1.442	27.211	66.000	5.347
20.	Mrs. Robinson's Lower Bed on Short Creek, Walker Co.	H. McCalley	1.336	0.722	3.560	26.566	64.228	5.646
21.	Upper Seam. Fork Shoals, Walker Co.	J. B. Durrett	1.325	0.793	4.976	27.169	62.135	5.720
22.	John Richardson's House, near Wilmington, Walker Co.	H. McCalley	1.310	1.076	1.398	30.647	62.183	5.772
23.	Coal Creek, Middle Bed, Jefferson Co	“ “	1.351	1.525	1.850	27.561	61.696	8.893
24.	Calvary Williams' (Upper Group), Jefferson Co.	“ “	1.391	0.521	4.175	22.415	62.482	10.928
25.	“ “ (Lower Group), Jefferson Co.	“ “	1.312	0.604	1.525	26.170	66.020	6.285

TABLE SHOWING PROXIMATE COMPOSITION OF COALS—INCLUDING SULPHUR—CONTINUED.

	LOCALITY.	ANALYST.	Specific Gravity.	Sulphur.	Moisture.	Volatile Combustible Matter.	Fixed Carbon.	Ash.
No. 26.	From Brake's Bend, Walker Co	H. McCalley	1.339	1.105	4.535	26.407	56.890	12.168
27.	From Tom Bradley's, Walker Co	H. McCalley	1.278	0.690	2.702	29.564	64.818	2.916
28.	Mrs. Bailey's (better part), Walker Co	H. McCalley	1.339	0.603	5.715	28.095	62.612	3.578
29.	Mrs. Bailey's (bony part), Walker Co	J. B. Durrett	1.416	1.236	1.533	30.405	51.962	16.100
30.	David Cobb's, on Lost Creek, Walker Co	H. McCalley	1.310	0.728	2.261	33.782	57.002	6.955
31.	From Guttery's Canoe Hole, Holly Grove, Walker Co.	J. B. Durrett	1.365	0.687	3.332	30.683	52.762	13.223
32.	Baker's Upper Bed, on Lost Creek, Walker Co	H. McCalley	1.324	0.695	6.355	31.086	60.665	1.894
33.	Baker's Lower Bed, on Lost Creek, Walker Co	" "	1.285	1.331	2.578	35.164	59.348	2.910
34.	Townley Bed, Upper Bench, Walker Co	" "	1.450	1.744	2.960	26.162	44.516	26.362
35.	Townley Bed, Lower Bench, Walker Co	" "	1.310	0.710	3.007	29.084	63.352	4.557
36.	Burton's, on Lost Creek, near Kansas, Walker Co	" "	1.315	0.586	2.606	34.110	56.628	6.656
37.	Jagger's Bed, near Eldridge, Walker Co	" "	1.233	0.574	3.091	29.044	56.537	11.328
38.	Beechy Hollow, near Shulough, Walker Co	" "	1.437	0.527	6.952	27.065	55.640	10.343
39.	Horse Creek, near Davis' Ferry, Walker Co	" "	1.365	0.711	1.848	28.365	58.213	11.574
40.	Robinson's Bed, on Horse Creek, near Davis' Ferry	" "	1.371	0.580	2.354	27.007	57.650	12.989
41.	" " " " " " "	J. B. Durrett	1.364	0.599	2.703	26.600	56.367	14.330
42.	Flat Creek, near Davis' Ferry, Walker Co	H. McCalley	1.362	1.516	1.674	33.199	54.540	10.587
43.	Mt. Carmel Church, Walker Co	H. McCalley	1.380	0.586	2.213	28.978	56.454	12.355
44.	Big Cane Creek, near River, Walker Co	H. McCalley	1.401	0.482	3.799	26.217	57.316	12.668
45.	Mrs. Burton's Upper Bed, near old Warrior Town	J. B. Durrett	1.318	3.070	2.052	38.078	55.265	4.605
46.	Phillips & Cordell Mine, near old Warrior Town	H. McCalley	1.290	0.649	3.098	34.552	60.745	1.005
47.	James Cole's Spring Branch, near old Warrior Town	J. B. Durrett	1.263	9.088	1.700	36.228	60.501	1.481
48.	E. J. Phillips', Walker Co.	J. B. Durrett	1.268	0.593	4.047	31.193	60.698	1.062
49.	Jim Hawthorne's, near Democrat, Walker Co.	H. McCalley	1.338	0.516	2.969	29.784	60.598	6.649
50.	Pratt Seam (average), near Birmingham, Jefferson Co	H. McCalley	1.300	0.918	1.501	31.185	61.508	6.110

TO DR. EUGENE A. SMITH,

State Geologist:

SIR—The following Report has been made in compliance with your request.

Very respectfully,

HENRY McCALLEY.

UNIVERSITY OF ALABAMA,
February 1, 1881.

ALABAMA NORTH OF THE TENNESSEE RIVER.

General Description.

1. *Topography, etc.*

The Tennessee River enters Alabama near its northeast, and leaves it at its northwest corner, flowing within the limits of the State a distance of about two hundred miles.

Coming into the State by what is known in Tennessee as the Sequatchee Valley, and in Alabama as Brown's Valley, the river flows southeast along this trough, some sixty miles or more, when it is suddenly deflected from this apparently natural course, towards the northwest, and this general direction it keeps until it passes again into Tennessee at the point already mentioned.

The southernmost point of its course in Alabama, is Guntersville, where it leaves Brown's Valley, and this point is about forty miles due south of the State line.

The portion of Alabama thus embraced in this great bend of the Tennessee River, it is proposed to consider in the following pages.

Boundaries and Area.—The northernmost limit of this tract is the Tennessee State line; on all other sides the river itself forms the boundary.

The area embraced is some 3,000 square miles, or nearly 2,000,000 acres, and includes the counties of Lauderdale, Limestone and Madison, and parts of Jackson and Marshall.

Surface Configuration.—This region, though now presenting, as a rule, an extremely rugged and broken surface, was once a high plateau, gradually sloping towards the south and southwest.

Then there were no mountains and valleys, hills and dales, within its area; but it was throughout simply a high, level plain, elevated some 800 ft. to 1,500 ft. above the sea, unrelieved by the many picturesque scenes which now meet the eye as one passes over it. Though now much worn away, it still contains some of the loftiest points within the State, landmarks of a former greatness.

Divisions.—A natural division of this area is into "Highlands" and "Lowlands."

By the term, highlands, we mean the extensions into this State of the "highlands" and "table lands" of Tennessee. By the term lowlands, we mean the low, flat, rolling country between the highlands on the north and the Tennessee River on the south. The highlands have for their surface rocks, the Carboniferous and Sub-carboniferous strata, with the exception of the St. Louis or Upper Siliceous division of the latter. The lowlands have principally, for their surface rocks, the St. Louis Limestone. The highlands, as here defined, include the greater portion (nearly four-fifths) of this area. On the north, they extend entirely across the State from east to west, and in the eastern and western thirds, they extend clear through to the river on the south. The lowlands are, therefore, confined principally to the southern central portion, and are, in a measure, limited to a narrow strip, bordering upon the Tennessee; but in places this strip sends out offshoots away into the interior, in and between the hills and ridges of the highlands, thus taking in considerable tracts of country. The highlands of the western half being extension of the *highlands* of Tennessee, have, of course, the same surface rocks as these. The highlands of the eastern half, being extensions of the *table-lands* of Tennessee, are likewise similar to them. The highlands of the western half have no such thing as a mountain, whilst those of the eastern half are composed entirely of mountains, being merely the terminal ridges and spurs of the great Cumberland chain. Those on the western half usually slope

gradually away to the lowlands below, whilst those of the east always end abruptly, being mountains. Those on the west, when not cut up into ravines and hollows, form a comparatively level plain, elevated some six to eight hundred feet above the level of the Gulf of Mexico; but in many places, especially near their southern edge, they are so cut up as to appear as a mere succession of ridges and hills. The highlands of the east, on the other hand, are merely broad, flat mountains, from eight to fifteen hundred feet above the sea, separated from each other by deep, narrow valleys, along which run the streams. On the west, these highlands have points extending down into the lowlands, but always connected to the main body on the north; whilst on the east many outlying, detached spurs and ridges rise up away out in the lowlands, like islands. All the rugged and broken portions of this region are due to the hard rocks of these highlands. The lowlands, in all their ramifications, are connected with the main body, bordering on the Tennessee: They are flat and rolling, with an average elevation of from five to seven hundred feet above the sea, and contain no very prominent land marks, except those formed by the rocks of the highlands.

We have thus seen that the highland and lowland areas differ as much in their general appearance as they do physically and geologically. The one is entirely different in its eastern and western portions, the other is more or less uniform throughout; the one is covered by its native forest, whilst the other, for the most part, is in a state of cultivation; and the soil of the one is poor, whilst that of the other is highly fertile.

Drainage.—Washed on three sides by the beautiful Tennesseee, and traversed every few miles, through its whole width, from north to south, by bold, rapid streams, this whole section of country is admirably drained. Its streams, with the exception of a few of the largest, all rise within its borders, and hence, are comparatively short. They are seen,

especially within the highlands, winding along the deep narrow ravines and gorges, cut down into the bedded rocks, where with a great noise and a rush, they leap over the numerous cascades along their route. Before reaching the lowlands, having run over nothing but rocks and pebbles, their waters are clear and sparkling. Confined to narrow limits, bounded by steep acclivities with little or no valleys between them, and having a great fall, they are unable to spread out, and hence lakes and marshes are almost unknown. With rapid currents, these streams, during freshets, often do much damage along their banks, taking away whole crops and even the soil of the narrow bottoms which occur along them. These bottom lands are never seen, within the highlands, on both sides of the streams at once; they are always faced by bluffs, jutting up against the creek on the opposite side. The Tennessee, during high waters, often rises out of its banks along the lowlands and does much harm; its backwaters extending up the creeks for miles, sometimes almost to the margin of the highlands. These streams, with the exception of the Tennessee itself, in accordance with the general inclination of the surface, and the dip of the rocks, all flow in a southerly direction and empty their waters into the Tennessee. With many large creeks boiling up in the characteristic "big springs" of its basins and hollows, with numerous smaller springs gushing out from its hill-sides and cliffs, and with never failing wells almost everywhere to be found, this country is well blessed with the purest and best of drinking water. Not all of the springs, however, nor all of the wells, afford pure water, for in many cases the waters are of a decided mineral character, and in some instances have gained for themselves more than a State-wide reputation for their medicinal qualities.

Soils.—The soil in this region varies from a very light and poor siliceous material, in some places almost pure sand, covering the greater part of the highlands, to a very dark and rich loam, forming much of the lowlands. The high-

lands of the western half, known as "barrens," covered principally by a light gray siliceous soil, include spots, sometimes of considerable extent, of fine calcareous soils, always colored more or less red. These spots are found, either upon the highest points of the "barrens," or in their deepest basins; the soils in these two positions being derived from entirely different rocks. Those on the high points are from the disintegration of the St. Louis Limestone, whilst those in the basins are from the impure and crinoidal limestones of the middle and lowest beds of the Keokuk or Lower Siliceous formation. On some of the high points within the "barrens," are found cherty nodules, resting upon the light gray siliceous soil, relics of the now departed calcareous soil, and showing its last resting place. These "barren" soils have heretofore been looked upon as almost worthless, but, judging from the rapidity with which they are now being taken into cultivation, are fast coming into repute, and these lands may, at no distant day, be sought after, not only on account of their productiveness of certain crops, but also, with their pure water and air, and delightful climate, as quiet summer retreats from the dust and turmoil of the towns and cities. Doubtless, under kind treatment, these lands will be found good for most fruit crops, as they have already been shown, by the aid of a suitable compost, to be fine for cotton, tobacco and small grain. These soils can be made to yield, so it is said, one-half of a bale of cotton, or two hundred and fifty pounds of lint cotton to the acre, and the advantages claimed for them will more than compensate for the excess of fertilizers used. These advantages are: the lands are cheaper; they are more easily worked; they are never overflowed; the fruit ripens sooner; the staple samples better. The greatest objection to them seems to be that they do not hold fertilizers well, being able to retain not even the small amount of organic matter which annually falls upon them. In many places they look as if they had been leached, so completely have all traces of organic mat-

ter been washed away. They would therefore impose upon the farmer the additional labor and cost of more frequent applications of the manure or compost. The soil of the highlands or table-lands of the east (the gray sandy soil of the Coal Measures), is also, as a general thing, very poor, often nothing more than pure sand stained with a little oxide of iron. These table lands afford fine pastures, over which the cattle of the farmers of the adjacent valleys roam from early spring until late fall. Such lands when fresh, or when they have any strength at all, seem to be especially adapted to all root crops. They, like the "barrens," do not hold manures well, and hence require frequent applications. These highlands are, as yet, but thinly settled, but are beginning to attract considerable attention. Being from some twelve to fourteen hundred feet above the sea, their atmosphere is pure and invigorating, a perfect safeguard against the chills and fevers of the lowlands.

The soil of the lowlands, or the red lands derived from the disintegration of the St. Louis Limestone, varies from a deep red colored clay loam, to a nearly black, loose, calcareous soil. These soils are coextensive with the lowlands, occupying their whole area with the exception of a few isolated localities along the creeks and very low places, held by the soils of the underlying rocks. They form the farming lands of North Alabama and are always susceptible of the greatest improvement. Though now in many places much washed, and apparently worn out and lying out in old sedge fields, still, their original fertility could, in all cases, be gotten back, within a few years, by a little judicious handling. Containing within themselves all the ingredients necessary for plant food, they could, if properly cared for, be made to last forever without the addition of a single load of manure or pound of fertilizer of any kind from extraneous sources. Some of these soils have been abused for at least seventy-five years; that is, they have been worked upon the very exhaustive method of ever taking off and never putting

back; they have been worked very shallow, they have been worked and trampled over during all seasons of the year and they have been cultivated year after year in the same crop, cotton, the only change being that of an occasional crop of corn, and still, though they have never been assisted in the least, are comparatively fertile wherever so situated as not to be easily washed away. Unlike the soils of the highlands, they are very retentive of all organic matter; taking well, manures and fertilizers of all kinds, and showing their effects for years after. Cotton and corn have ever been their staple commodities, though they are well suited to a great diversity of crops. The dark loamy lands of the South, lying along the river and creeks, made dark by the superabundance of organic matter, are especially suited to corn; they are the corn lands. The higher lands, the rolling lands in between the creeks and off from the river, the brown lands and the red lands, are the true cotton lands, of course, the brown and black tints of these lands are proportional to the amount of organic matter with which they are impregnated. The redder lands, the cotton lands, are also well adapted to the horticulturist. Though in effect very limited in its chief productions which are reduced almost to two, cotton and corn, there are few areas, of the same extent, which are capable of yielding a greater diversity of crops than Alabama, north of the Tennessee river.

Forests.—The forests of this region are chiefly confined to the highlands and to the inaccessible places of the lowlands. The highlands are still, in great part, covered with their native growth. Only a few small patches, immediately surrounding the cabins of the scattering settlers, and the fertile, though narrow, creek bottoms have, as yet, been cleared. The growth of the true highlands, or highlands of the west, consists principally of a dwarfed, hard, twisted grained post oak or blackjack, and the short leaf pine, though along the creek and ravines, especially near the heads of the ravines are found some noble trees of white oak, red oak, poplar,

chestnut, etc. Saw mills, temporarily put up, are now often seen along these branches and creeks, and this fine timber will soon be a thing of the past. The growth of the highlands of the east is luxuriant, consisting, upon the level plateaus, or table lands, of oak, hickory, chestnut, pine and a few poplars, walnuts, etc. Along its sides, over the Mountain Limestone, are found, principally, cedar and pine, though some oaks, and occasionally a walnut and a poplar appear. The cedars cover the limestones of this formation, and the pines, the sandstones; their lines of separation are often very marked, and can be easily recognized from a distance, as the mountains are approached.

There is, comparatively speaking, but little left of the native growth of the lowlands. This little is confined, principally, to the creeks, very low places, and knolls, and consists, for the most part, of the different varieties of oak, hickory, and cottonwood. Occasionally one meets with a fine grove of oak and hickory, covering a high level area, but in most cases, such a grove will be surrounding or adjacent to some residence.

2. *Geology.*

Within this area, *erosion*, due to the action of running water, has laid bare many fine natural sections. It is thus made an interesting field to the Geologist.

An enumeration of the geological formations which are exhibited in these natural sections, or which occur within this area, together with their equivalents in other states, and their lithological characters, have already been given by the State Geologist in his report for the years 1877–78.

He also gives there a general section of the western part of this area, passing through Courtland and Moulton, which shows the relative positions of the different geological formaations, their respective thicknesses and general dip. This information will be found in the above named Report, pages 11–18 inclusive.

In the section or cut referred to, it will be noticed that the two upper formations, viz., Mountain Limestone, and Coal Measures, are not shown north of the Tennessee River. This is for the reason that those two formations do not occur north of the Tennessee, except in Madison and Jackson counties, entirely east of the line of the section.

In the above named Report the general characters of the rocks making up the various formations in North Alabama, together with detailed descriptions of sections obtained in various localities, have been given.

In this Report, after an enumeration and a general sketch of the geological formations recognized in this region, I shall present additional details from parts of the country not covered by the previous Report referred to.

Beginning with the lowest, the geological formations to be described in the details below, together with their most characteristic strata, are as follows:

1. *Silurian.*—Of this age, the following rocks were believed to have been recognized:

(1) Gray, fossiliferous, granular dolomites and limestones and loose chert, belonging to the sub-group, Knox Dolomite, of the Quebec group of the Lower Silurian—appearing only in the anti-clinal valley of the eastern border.

(2) A dove-colored and highly fossiliferous limestone, believed to be of the Trenton group of the Lower Silurian. Found only in the same locality as the above.

(3) A highly fossiliferous, argillaceous limestone of the Nashville or upper group of the Lower Silurian rocks. Seen in the above anti-clinal valley and along the creeks of the western half of this district, as they flow into Alabama from Tennessee.

(4) Gray and variegated fossiliferous limestones, often shaly, a magnesian limestone, and also a dark gray sandstone—Rocks of the Niagara or Lowest group of Upper Silurian. They are next below the Black Shale. Seen along the creeks and ravines of the west, near the State line.

2. *Devonian.*—A black bituminous shale, alternating with thin seams of a fine grained sandstone seen along the anti-clinal valley of the east, and along the creeks and ravines near the State line, from Flint River westward. The most southern point at which these rocks were seen was near the Blair's Ferry road, in S. 34, T. 2, R. 6, W., in a ravine leading out from Elk River.

3. *Lower Sub-Carboniferous.*

(1) *Lower Siliceous or Keokuk or Burlington Beds.*—These rocks vary from an almost pure flint to nearly pure marble. They consist of flint or hornstone, shales, sandstones, and limestones, in all grades of purity. They are supposed to cover about one-half of this district, extending from east to west. Though highly developed in the western half, they are seldom seen or rarely come to the surface in the eastern half. They are cliff-making rocks, their upper or siliceous, or flinty portion, always forming the capping stone. They are regularly stratified, as shown along these cliffs, the under rocks, or limestones and sandstones of all grades of purity, seldom coming to light, except along these cliffs, and in a few basins where the siliceous crust has been cut through and removed. The rocks of the western half are, also, more characteristic than those of the eastern. These rocks have been fully described in the report already referred to. Thickness, some 150 feet.

(2) *Upper Siliceous or St. Louis Limestone.*—Impure or cherty limestones. These rocks are the surface rocks of the flat and rolling country bordering upon the Tennessee. They cover about one-third of the area under consideration, appearing in their greatest force near its central portion; here they extend from the river almost to the Tennessee line. They form the rich and fertile lands of this area, and it is doubtless mostly because of this fertility that all of the towns of this region are built upon its slight knolls. These rocks are not often seen in regular beds, but generally as scattered fragments, associated with sandy clay and cherty, fossilif-

erous nodules, the results of their disintegration. They, like the underlying, lower sub-carboniferous rocks, seem to thin out as we go eastward, in which direction the two formations appear to become consolidated into one, intermediate in properties between the two. Their greatest thickness is about 200 feet. They, too, have been fully described.

4. *Mountain Limestone, Chester Group.*—Limestones, sandstones, and shales. These rocks are confined to the eastern or mountainous half, their most western appearance being in Capshaw mountain, a few miles west of Huntsville.

They form generally the *sides* of the mountains, from just below the sandstone capping of the same, down nearly to the base in some cases, seldom themselves, however, extending out into the level or rolling plains below. The propriety of the name Mountain Limstone, is thus quite apparent. Near the western limits, the isolated peaks and spurs usually lack the capping of sandstone, being formed entirely of these calcareous rocks down to their sloping bases. The seam of sandstone often repeats itself, once or twice. These rocks vary very much in their respective thicknesses at different localities. They have a thickness ranging from 600 to 800 feet.

5. *Coal Measures.*—Sandstones, conglomerates, shales, and coal. These rocks as they lie upon those last mentioned, or as they form the tops of the principal mountains, are, of course, found only in the eastern half. They generally form the flat, or slightly basin-shaped area on top of the mountain, or the *table-lands;* and around the rims of these table mountains, the lower sandstones and conglomerates of this formation, usually form a line of cliffs, 30 to 50 feet in height, immediately above the Mountain Limestone. Near the foot of these cliffs are found the coal seams. There are sometimes as many as three of these, one above the other, separated by sandstones and shales. These seams vary in thickness from a few inches to several feet. Their coal also

varies much in quality, from a very pure to a very impure variety. Many of these seams have been worked in a small way by the neighboring blacksmiths, and a few on a larger scale, as the Elkmont coal and R. R. Co. seams, those on Monte Sano, near Huntsville, and the "Old Huntsville Mining and Manufacturing Co." seams. These seams, on account of their great height above the adjacent level country, can be worked on a large scale only by a great outlay of capital at first. Thickness of Coal Measures, from 150 to 400 feet.

6. *Stratified Drift or Orange Sand.*—Sand; rounded gravel or pebbles, iron conglomerates, formed of rounded pebbles held together by oxide of iron. These rocks are of no great superficial extent, occuring only in small spots covering a few high places.

II. COUNTY DETAILS.

Lauderdale County.

Area and Boundaries.—This county occupies the northwestern corner of Alabama, or the western portion of the section under consideration. It is bounded on the north by the State of Tennessee, on the south and west by the river Tennessee, and on the east by Limestone county and Elk River. It has an area of about 728 square miles or 465,920 acres.

It is very irregular in its shape, being from east to west some fifty-six miles long, whilst its average width from north to south, is not more than thirteen miles. Extending up to the vertex of the acute angle formed by the southern boundary of the State of Tennessee, and the Tennessee river, it projects beyond the extension of the Alabama and Mississippi line, south of the Tennessee, and thus takes in some thirty square miles, in this corner, which would have belonged to Mississippi, had the above line between Mississippi and Alabama been allowed to crop the Tennessee. Its eastern boundary is the line between Ranges six and seven, west from Huntsville, for some twelve miles, or until this line strikes Elk river, when this river forms the boundary down to the Tennessee. Its southern and western boundary is the river Tennessee, which, in the pursuance of a course about at right-angles to that for which nature seems to have intended it, is forced to twist and turn, thus making these lines anything but straight.

Drainage.—With a swift river sweeping more than one-half its boundary, and with many clear rapid streams pass-

ing through its whole width from north to south, this county has a complete system of drainage. Not a marsh or a pond of any size can be found within its limits, unless immediately upon the Tennessee. Every stream in the county flows within the county limits to the Tennessee, this river receiving *directly* the waters of every stream of any considerable size, with the exception of Anderson creek. The principal creeks are, commencing on the west, Second, Cypress, Shoal, Blue Water and Clear, not counting Elk river, which, like the Tennessee, does not flow through it, but merely forms a portion of its boundary. Of these, the three principal are, Cypress, Shoal, and Blue Water, draining all the central portion of the county from north to south, partly rising within the state of Tennessee. They alone of the streams of the county have tributaries of any size, though the smaller streams of the eastern and western portions of the county cannot, by any means, be looked upon as insignificant, especially during freshets or high waters. Of these smaller streams, Anderson, First, Six-mile, Bluff, and Four-mile, are the most important. The three larger creeks, together with Anderson, all rise near the State line, either just north or south of it, in the great highlands of Tennessee or their extensions. All, flowing south, empty their waters directly into the Tennessee with the exception of Anderson creek, which flows into Elk river, about six-miles from its mouth, or one mile below the point where it first touches the county. The smaller streams all rise near the central portion of the county, north and south, and flowing south, empty their waters into the Tennessee. They thus help to drain the southern half of the county. These streams being all fed by pure, bold, everlasting free-stone springs, never go dry, and hence, man nor beast in Lauderdale county need ever grow thirsty for want of pure water. The surface of this county having a natural inclination towards the south, and being greatly wasted away on the south by the erosive action of water, these streams all have a great fall, and hence rapid currents. Cascades are

numerous along them, and the amount of water power thus allowed to run to waste is too great to be estimated. These streams being confined to narrow limits, and their fall being so great, all, even the smallest, are dangerous during high waters.

General Configuration.—In general, this county presents an extremely broken surface. bordered on the south by a large, crooked stream, with a narrow basin. More specifically: in the north, it consists of a high plain-like area, cut up by deep, long, narrow ravines, extending north and south, from which ramify other smaller ravines in all directions; in the central portion, of ridges and ravines, hills and hollows; and in the south, of a greatly inclined basin of very unequal width, filling up all the southern bends in the river, and interspersed here and there with small knolls. Nearly all of this diversity of scenery, etc., is due to the action of running water; for, originally the whole area occupied by this county had not a single ridge or hill, ravine or hollow, but was a plain, gently sloping from the north to the south, and with entirely different rocks, soil, and forests in the northern and southern parts. This northern portion (about five-sevenths) constitutes the "barrens," or the highlands; the southern portion (two-sevenths) forms the lowlands. The highlands, recognized by its poor, white, siliceous soil, and its growth, principally, of seemingly stunted trees; and the lowlands, by its rich black and red soils, and its growth of oak and hickory. These differences would strike the casual observer, and to make sure one would have only to examine the rocks. The dividing line between the highlands and lowlands, is very crooked, especially in the western and eastern parts of this county where most broken.

This county may perhaps best be described by dividing it into three divisions, extending clear through from north to south. The first or western third extending eastward a few miles beyond (east of) Bluff Creek; the central portion

thence eastward to Shoal Creek, and the eastern or third portion, from Shoal Creek to the eastern boundary of the county.

The First or Western Division.—This portion of the county is very broken indeed, so much so as to make it impossible to have a road across it from east to west, except along the river basin. It consists, it may be said, entirely of the highlands, cut into ridges by deep narrow ravines. These ridges extend down to within a mile of the river, or less, where they end more or less abruptly. These sharp terminal points of the ridges are all rounded on top, and covered with loose cherty rock, but as they recede towards the highlands, they generally widen out, becoming flat on top, their sides steeper, covered with fewer loose rocks and more bedded ones. The ravines between the ridges, narrowing as they go back from the river, keep their depths for long distances, but finally gradually emerge into the highlands above. The flattening of the pointed ridges on top as they go back, occurs whenever the streams or ravines on each side of them are so far apart as to leave a portion of the original uneroded land surface between. Being parts of the same level highlands on the north, these ridges all have a uniform height, or very nearly so, corresponding to these highlands. These ridges have their bedded rocks almost level, dipping a little, perhaps, towards the south or southwest, hence they have been cut out, and were not cast or thrown up after the manner of all true ridges. They are now ridges merely because the parts between them have been washed away whilst they have been left. The ravines, as would be inferred from what has been said, are widest at their mouths, where their slopes are most gentle, narrowing as they go back with their sides becoming steeper. In many of these ravines there is at present no running water at all, and in many others the streams are very insignificant indeed, merely small spring branches.

The Second or Central Division.—This division is drained by Cypress Creek and its tributaries, and by the western

tributaries of Shoal Creek; this portion of the county is not nearly so much broken as that just described, being, except near the water courses, a comparatively level tract, especially in its central and western part. The highlands constituting about two-thirds of the whole are more even and uniform, not so much cut up by ravines and more gently and gradually passing into the lowlands below. Not having many cliffs along its river border, it has some first bottom land. The lowlands are traversed by Cypress Creek flowing in many places through a deep narrow channel, which, near the northern limits of the lowlands, is bounded by steep hills and ridges deeply furrowed by enormous gullies. The eastern portion of this division, or that part bordering upon Shoal Creek, is more or less broken, clear through to the river on the south: this third contains four times as much lowlands, or fine, rich lands, as all of the rest of the county. It contains all the rich, fertile land in the great southern bend of the river southwest of Florence. These lands constitute for the most part a gently undulating plain, second bottom lands, and much of them have been in cultivation in cotton and corn, cotton principally, for the last seventy-five years, and though no fertilizers of any kind have ever been added to them, they are still comparatively fertile and could easily be gotton back to their primitive value by a little judicious handling.

The Third or Eastern Division.—This division presents a great diversity of scenery, being more broken than the central division, though not so much so as the western. It is drained by Six Mile, Blue Water, Clear, First and Anderson Creeks, and the eastern tributaries of Shoal Creek. These streams all flowing southerly are, of course, more or less parallel, and are not more than three or four miles apart. They all flow through deep narrow ravines, the margins of which along the largest of these streams are deeply indented by the larger tributaries, forming what might be termed creek-hills and ridges. These ridges and hills extend along

through to the Tennessee, and are themselves cut up by deep narrow ravines, down which the smaller tributaries flow. The smaller streams have also these side ravines but not hills and ridges. These side ravines have wide mouths, soon narrowing up, and they are as a general rule short, the streams running down them having a great fall and often several falls.

The country in between these creeks and their tributaries, in the highlands, is level, whilst in the lowlands it is rolling, especially so near their northern boundary. This division has its river course bordered by bluffs of the highland rocks, and hence it has no first bottoms, except along the mouths of the creeks, and here but little, since these are narrow. Its second river bottoms, or its lowlands or red lands, have an average width of not more than three miles, and are by no means level, but rolling, and much washed and spotted over with old worn out fields, cut up by cross branches, etc. There are also scattered over it, in the lowest places, many barren spots in which the characteristics of the highlands show themselves. Many of these creek and river hills and ridges are still covered with their native forests, it being almost impossible to get the wood off of them.

Soils.—The soils of this county belong to the two characteristic varieties, the white siliceous soil of the highlands, and the red loamy soil of the lowlands. These soils have already been fully described. The soil covering the river and creek hills, within the highlands, derived from the disintegration of the impure limestones of these rocks, is more or less red and quite productive. On account of the steepness of these hills, it has to be cultivated to a very shallow depth, and hence the soil is liable to be washed away by every freshet or hard shower. This county is so well drained that there are few places lying uncultivated because too wet, and these few are found next to the river, in its first bottom. These first bottom lands, when so lying as to be overflowed,

but not subjected to currents, make the finest corn lands, not suitable, however, to cotton, which goes too much to stalk.

Springs.—Springs are found in this county in all places where the country is the least broken. They are seen gushing out from all along the creeks and ravines, and cliffs and hill-sides, and often boiling up from the low flat places. Many of them are of good size, and most of them of pure free-stone water. Chalybeate springs are common; and, in the upper portion of the county, springs of other medicinal properties occur. They seem to be most numerous near the southern edge of the highlands, the country here being most broken; and more numerous within the highlands than the lowlands, though, as a general thing, not so large. The road leading from Gravelly Springs to Waterloo, running along the foot of the highland ridges, has along it more springs than any road of same length known. As an average sample of the large springs of the lowlands, Cave spring might be mentioned. This spring is found within the Colbert Reservation. It flows from out of a cave, and runs off, swiftly, in a stream some fifteen feet wide, and an average depth of at least six inches.

The most noted springs in the county, or rather in North Alabama, are the Bailey Springs, nine miles northeast of the city of Florence. They are several in number, namely: "Rock Spring," "Brick Spring," and Soda and Alum Springs. The first two are so called because they are walled up with those materials. "Rock Spring" is the original Bailey Spring; its waters were roughly analyzed by Prof. Tuomy, and its principal ingredients found to be Carbonic Acid, Iron and Soda. The waters of "Brick Spring" are said to contain more iron than those of "Rock Spring;" they are both believed to hold arsenic, in solution. The Soda and Alum Springs are said to be strongly impregnated with the Carbonates of Soda and Potash. Their waters appear to be something cooler than those of Rock and Brick Springs. They are all tasteless. As to the curative properties of these

waters, references and certificates are innumerable. They are said to be especially good for Dropsy, Dyspepsia and Scrofula, and all skin and liver diseases. These springs are located at the head of a little ravine, which extends down to Shoal creek, one-half mile distant. They flow from under a cherty ridge, formed of the Lower Siliceous rocks, on the top of which is situated the commodious hotel, and between the spring and hotel, along side of the hill, are the beautiful grounds, with their tastefully laid out walks, etc.

Forests.—The forests, or wooded lands of this county, might be said to be coextensive with the "barren" rocks, for wherever these rocks form the surface, there too, as a general thing, will be found the native growth still standing. The exceptions to this general statement are few. It is true that most of the long, narrow bottoms along the creeks within the "barrens" are cleared up, but the surface rocks of these tracts, are generally, whilst belonging to the same formation, entirely different from those constituting the barrens. The latter are a flinty or coarse cherty rocks, the other varies from an impure to a very pure limestone. Much of the timber found within the lowlands is over these cherty rocks, along the creeks and covering the very low places. Occasionally a grove or narrow strip of timber may be found on the true "red lands," but they are few and far between. The principal growth of these "highlands" is a hard, scrubby, twisted grained oak and the short leaf pine. The latter occurs in patches. Along the creeks and ravines of the highlands and sometimes upon the highlands themselves, but especially near the heads of the ravines, there are found some fine trees of white oak, chestnut, poplar, maple, etc. These large trees are fast being cut down. The timber covering the small spots within the lowlands consists principally of the different varieties of oak, hickory, and cotton-wood.

GEOLOGICAL FORMATIONS.

1. *General Description.*

The surface area of this county is made of the following geological formations:

(4) Superficial Drift Deposits.

(3) Lower Sub-carboniferus. { (1) Upper Siliceous or St. Louis Limestone. (2) Lower Siliceous or Keokuk.

(2) Devonian or Black Shale.

(1) Silurian.

KINDS OF ROCKS.

Silurian.—Variegated, argillaceous, and shaly limestone—some of the argillaceous looking limestones, magnesian limestones. They belong generally to the Niagara group, of the Upper Silurian formation, and to Safford's Nashville group of the Lower Silurian. They cover a very small extent of surface, being found only near the State line, along the creeks and ravines of the central and eastern portion of county.

Devonian.—Black bituminous shale, and a fine grained, thin sandstone. The shale, the principal rock, occurs in several seams, divided by this thin sandstone. Sandstone, generally, dark gray in color. These rocks, being just above the last named, are of about the same superficial extent. They are about eight feet in thickness.

Lower Siliceous or Keokuk.—Bedded chert, siliceous gray and blue limestone, shaly limestones, blue and gray limestone, and white crinoidal limestonc. The ecrinital or crinoidal limestone varies in color from dark gray or blue to perfectly white. The lighter variety generally contains the greater number of fossils. This limestone also varies much in composition, sometimes being very siliceous, at other times an almost pure limestone with few fossils, and still again it is a mere mass of crinoidal stems. These rocks are regularly stratified; the upper strata consisting of chert,

often flint, and the middle and lower strata, of impure, pure, and shaly limestones. Some of these lower rocks, ecrinital limestones, are in places a very good marble, and could be quarried with ease, since they have regular planes of division. The rocks of this Lower Siliceons group form about five-sevenths of the county, almost the entire eastern and western thirds, especially in the western third, extending clear through to the river. Through the central portion, however, on account of a great southern bend in the river, the county widens out, and a considerable area underlaid with rocks of the Upper Siliceous group, comes in south of the highlands.

In general the country covered by these rocks, the "barrens" namely, as above explained, is a gently inclined plain, except near the water courses, (and especially when these are numerous), where the country becomes a mere succession of ridges and isolated hills.

Upper Siliceous or St. Louis Limestone.—Cherty, fossiliferous limestones. These rocks are pre-eminently the rocks of the lowlands, and occur in but a few small patches outside of them, on some of the higher points of the highlands. Being easily disintegrated, they are seldom seen in beds. The cherty portions, generally a few inches in diameter, are often met with, especially on the hills and knolls of the lowlands. They do not occur in this county in any very great thickness, since the Lower Siliceous rocks make their appearance in the beds of the streams which cut through them, and along the banks of the Tennessee. They cover about 200 square miles, principally southwest of Florence, filling up the great southern bend above spoken of and making the very fertile area elsewhere described. All of these lowlands were once fine, but now, where the country is most broken, especially near their northern boundary, there can be seen many old fields lying out and grown up in sedge, bushes, briars, etc. Florence and Rodgersville are both located near the northern boundary of the lowlands.

Superficial Drift Deposits.—Beds of gravel; gravel and sand; and iron conglomerate, rounded pebbles held together by oxide of iron. The extent of these rocks is very limited, indeed, when compared with the underlying Sub-carboniferous rocks. They are found only in a few small spots covering some of the higher points of the highlands.

2. *Details and Sections.*

Silurian and Devonian.—These rocks were seen on Blue Water, and according to Professors Tuomey and Safford, and others, appear on the other large streams, from Shoal Creek eastward, as they enter the State from Tennessee. The lowest, or most southern point at which they were seen, was in the southern portion of S. 25, T. 1, R. 9, W., in the bed of a dry branch, along which Blue Water partly flows during very high waters, and just south of the mouths of the sinks to be hereafter described. Along this branch, within a distance of seventy-five yards, Black Shale, separated by a thin seam of dark fine grained sandstone, appeared in outcrops some eight times. The dip was very slight and both north and south, thus showing undulations. These rocks (Silurian etc.,) were next seen at Allen's Ford, some two and a half miles above the last named locality. At this place they occur in the bluff forming the eastern boundary of the valley. The foot of this bluff was at least fifteen feet above the creek. The rocks were regularly stratified and had a decided dip southward. The section is as follows:

Section at Allen's Ford, on Blue Water Creek.

Lower Siliceous.	(12) Earth	15 ft.
	(11) Light grayish blue limestone	8 in.
	(10) Dark shaly limestone	4 in.
Devonian..	(9) Black shale	6 in.
	(8) Dark, shaly, reddish yellow sandstone	6 in.
	(7) Black shale, with divisions of a dark sandstone	4 ft.
	(6) Dark sandstone	8 in.
	(5) Black shale	1 ft.
	(4) Dark shaly sandstone	1 ft.
	(3) Black shale	3 ft.
Silurian...	(2) Light colored limestone, shaly towards top	4 ft.
	(1) A variegated, hard, compact limestone	2 ft.

Loose slabs, some two and three feet in diameter, of this Black Shale, were also seen in the bed of the creek at the State line.

Sub-Carboniferous.

(1) *Lower Siliceous or Keokuk.*—Just south of the road at Binford's or Smith's Ford on Elk River some fifteen feet of a shaly siliceous limestone were seen, changing to beds of regular chert below. The Elk river hills occurring along this road are more or less red, formed, principally, from the impure limestones of this formation. Just before reaching Rodgersville, the road crosses several narrow strips of "barren" land. These "barren" rocks extend down about to Rodgersville from the north, though there is considerable "red land," in spots, north of this town. Along the road from Rodgersville to Florence, the same rocks are seen at all the creeks and branches, and in all the very low places and gullies. From Rodgersville to Blue Water, this road is just within the "red lands," or near the line separating the red lands from the barrens. At the crossing of First Creek, the following rocks were seen in the creek and along the road as it rose the hill on the west:

Section on First Creek.

(10)	Loose nodules of fossiliferous chert mixed with red clay, forming surface.	
(9)	Shaly cherty limestone	5 ft.
(8)	White siliceous clay, disintegrated chert	2 "
(7)	Shaly and yellowish cherty limestone	18 "
(6)	Shaly limestone, argillaceous below	4 "
(5)	White plastic siliceous clay, containing cherty fragments	2 "
(4)	Soft, yellowish white plastic mass or clay	15 "
(3)	Cherty argillaceous limestone, yellowish when weathered	2 "
(2)	Shaly limestone, becoming cherty below	3 "
(1)	Hard, bluish gray limestone, making small step-like irregularities in the creek.	

Beds numbers 4, 5 and 8, exhibit well the results of the weathering of the flinty "barren" rock, of which Prof. Tuomey speaks.

The hills and bottom lands of this creek, together, are not more than a quarter of a mile wide.

At the road crossing, we have the following

Section on Clear Creek:

(2)	Shaly limestone, with chert	10 ft.
(1)	Dark gray shaly limestone	2 "

The bottom and creek hills of Clear Creek are no wider than those of First Creek above.

As the iron bridge across Blue Water was approached, the following rocks were seen, beginning at the top:

Section on Blue Water Creek.

(8)	Bedded chert	4 ft.
(7)	White siliceous clay, with nodules of chert	3 "
(6)	Bedded chert	10 "
(5)	Shaly limestone	3 "
(4)	Bedded chert	30 "
(3)	Shaly limestone	6 "
(2)	Cherty limestone	8 "
(1)	Beautiful white crinoidal limestone—a very good marble—extended down to the water edge	4 "

No. 1 is the rock from which the locks at Muscle Shoals are made; and No. 7, affords another example of the results of the weathering of the hard cherty rocks.

These rocks are nowhere better exhibited than along Muscle Shoals, which have been so well described by Prof. Tuomey. They can be seen both in the river forming the Shoals, and in the perpendicular sections made by the cutting of the present canal. The rock which forms the Shoals in the river at the mouth of the Blue Water, is a dark grayish blue, very hard, fossiliferous cherty limestone. The upper beds of this rock have been weathered into a porous mass, the cherty

portions remaining prominent. The canal being cut along the northern bank of the river, is, of course, between the river and the cliffs which line its northern bank. These bluffs are not continuous, but are separated by gaps, down which flow the streams and branches. The smaller branches, in reaching the river from the adjacent high level lands, often have considerable falls.

In a bluff just below the mouth of Blue Water, the following rocks were exposed:

Section om Tennessee River, below Blue Water Creek.

(10)	Chert, with reddish clay partings to top of bluff	15 ft.	0 in.
(9)	Friable, rotten shale with alternating thin seams of chert above	3 "	0 "
(8)	Shaly limestone	0 "	10 "
(7)	Shale with cherty concretons	3 "	0 "
(6)	Shaly limestone	0 "	6 "
(5)	Alternations of light fossiliferous limestone and shaly limestone	8 "	0 "
(4)	Shaly limestone, slightly siliceous, and with few fossils	3 "	0 "
(3)	Alternating thin beds of fossiliferous cherty limestone and shaly limestone	12 "	6 "
(2)	Light fossiliferous limestone, with thin seams of chert	5 "	0 "
(1)	Rocks covered with debris from above, forming sloping sides of the canal, about	15 "	0 "
	Thence to river level	10 "	0 "

Another section about three quarters of a mile above that just described, is as follows:

(6)	Fragments of chert, imbedded in red clay, forming surface	20 ft.	0 in.
(5)	Bedded chert	10 "	0 "

(4) Hard, siliceous crinoidal limestone, in four regular beds, each about four feet thick, separated by thin strata (1 inch) of shaly limestone.:	16 ft.	0 in.
(3) Siliceous shaly limestone, lower part merely bedded chert	5 "	6 "
(2) Hard, light gray, tolerably pure limestone.	6 "	0 "
(1) White fossiliferous limestone to bottom of section	15 "	0 "

Though these two sections are so close together, they show a great variation both in the composition and relative thicknesses of the different strata. In some places, the river cliffs seem to be made up almost entirely of thin beds, six inches in thickness, of fossiliferous cherty limestone.

The material of which the locks of the canal have been constructed, is a beautiful white crinoidal limestone, which, judging by the appearance of the locks, is most admirably adapted to architectural purposes.

According to Prof. Tuomey's observations the rocks of the Lower Siliceous Group, in the vicinity of the Muscle Shoals, are about one hundred feet in thickness. They are exposed along Blue Water Creek, up to the State Line.

One mile above the iron bridge over the creek, a very good example may be seen of effects of the weathering of these hard, siliceous, crinoidal limestones.

The rock in question was originally the same as stratum No. 4 of section last given above, but has been changed into a reddish yellow clayey substance, very porous and friable; in which are embedded the almost unchanged crinoidal stems. The whole stratum is now so soft that large masses of it can easily be broken off and crumbled to pieces with the hands, the crinoidal stems falling out like grains of wheat from so much chaff.

At Phillip's Mill, the rocks of this formation were finely exposed, both in the creek and in a bluff above it, some seventy-five feet high. The rocks of the creek were the same

hard, grayish blue, cherty limestones as those seen in the Tennessee.

About one mile above this mill, on Mill Creek, a tributary of Blue Water occur very large slabs of cherty limestone. These hard, cherty slabs are underlaid by soft, shaly limestone; and the weathering out of the softer, lower rock leaves the other prominent and projecting, thus forming numerous little step-like offsets, which make beautiful cascades. Still higher up, about five miles from the State line, this creek entirely disappears through the shaly limestone of this formation, and after having run underground some two hundred yards or more, reappears, principally in the same rock. This locality is known, throughout this section of the country, as "the sinks." Before reaching this point, the creek runs between two ridges, or rather along a deep narrow valley, bounded by steep acclivities, on top of which the country is level. The sides of this valley gradually converge, but just before they come together, or just after passing the mouths of the sinks, the valley makes a sharp turn from south to west and instead of flowing around this sharp curve, the creek has cut its way under a point of land to the channel on the other side. The openings by which the creek disappears are one-fourth of a mile above the sharp curve, and of course, in the cliff forming the western boundary of the valley. They occur along the cliff for a distance of seventy-five or one hundred yards, separated by partitions, and are at their outer edge some eight feet high, dwindling down to two or three within twenty feet. The mouths of these openings are, as we have said above, mainly in the shaly limestone, though their roofs are formed of the harder and more siliceous rocks. These openings were partly filled up with old logs, rails, etc. The water at the time of my visit being very low, was flowing only through the upper or most northern, and smallest opening, but during high waters the greater portion goes through the other, larger openings, and when they all combined, are not sufficient, the surplus flows

around the sharp curve, or keeps the valley along two channels, which are at other times dry. The largest of these openings, the most southern one, it is said, has been traversed its whole length, but this is extremely doubtful. In the field covering the point under which this stream passes, the earth has fallen in, in several places, showing the subterranean channel to be about fifteen feet beneath the surface.

This field is considerably lower than the surrounding country, outside of the valley. The visible outlets, two in number, are very small in comparison with the inlets, and it seems impossible that they could permit of the passage of all the water that flows off below them. The stream not only starts off boldly, but even has some back water, hence it is believed that there are other outlets, "sub-aqua." There seems to be little regularity in the dip of these rocks, near the mouths; in places, they look as if they had been broken apart and then squeezed up together. The principal outlet is in one of these cracks or joints. With the exception of a few beds of loose pebbles, there appeared to be no obstruction along the open channel of the creek.

About one-fourth of a mile above the sinks, two bold springs break out about half way up the cliff. They flow from the shaly limestone, just above the cherty rocks forming the roof to the opening. About three and one-half miles above the sinks, near the mouth of Hurricane creek, occurs a bluff some seventy-five or eighty feet high, of the beautiful white crinoidal limestone, which makes so prominent a feature of this formation. It was regularly stratified, occuring in beds of three feet thickness, separated by thinner shaly strata. This rock had been quarried to some extent, and, on account of its being disposed in regular beds of such a convenient thickness, it might be gotten out cheaply. The creek, too, runs along the base of the cliff, furnishing a channel for transportation during high water. The cliff was covered at its base, with about twenty feet of debris. At Wilcox and Smith's mill, the shaly and cherty rocks of this formation

are seen in beds of about fifty feet thickness. In this section of country, there is much fine timber of oak and poplar, even outside of the bottoms. Along the little short ravines leading down to the creek a mile or so from State line, are several small rock houses, as they are called, formed by the wasting away of the soft shaly limestone from beneath a capping of hard, cherty rocks. These rocks seem to have a slight dip to the north, which, taken in connection with the fact that the same rocks have a slight southward dip near the sinks, goes to prove that they are undulating. At the State line, forming the western boundary of the valley, was a cliff some hundred feet high of the ecrinital limestone, more or less cherty and shaly. Just within the State line, in the field between the above named cliff and the creek, there are some four or five sinks, some of them bottomless, i. e., with a rail as measurer. In some water is standing, and during freshets, the water boils up out of all of them. They are doubtless connected with the creek, for in the creek bank, just opposite a large piece, as it were, is taken out, and just here there used to be, in the bed of the creek, a hole which swallowed up all of its water. The nearest of these sinks is some hundred yards from the creek.

Much of the country northwest of Lexington is broken, the creeks and small branches, trbutaries to Blue Water, being numerous. In all of these branches, occur shaly and cherty limestone, and chert of this formation. The country is tolerably thickly settled along water courses, the soil along the steep hill sides, formed from these impure limestones, being quite productive. Lexington is situated on a little red cherty hill, surrounded by "barrens." At the bridge across Shoal Creek, on the Florence and Athens road, the chert and cherty limestones are exposed in a section of fifty or sixty feet in height. In the creek they form shoals.

These rocks are seen up this creek at least as high as the crossing of Military road. This road approaches the creek from the east, by a deep narrow ravine, along which are seen

many beautiful ferns. Bailey Springs, some two miles down the creek from this ford, flow from the chert of this formation at the head of a little ravine, about one-half of a mile long, extending down to Shoal Creek, along which ravine the following rocks were observed:

Section near Bailey Springs.

(11)	Bedded chert, seen only up to level of the Spring	3 ft.
(10)	Dark grey cherty limestone	1 "
(9)	Bedded chert	20 "
(8)	Alternations of siliceous and shaly limestone with chert	15 "
(7)	Crinoidal limestone, highly fossiliferous	20 "
(6)	Dark grey cherty or siliceous limestone	2 "
(5)	Crinoidal limestone	25 "
(4)	Dark grey limestone	3 "
(3)	Crinoidal limestone	15 "
(2)	Dark grey limestone, few fossils	1 "
(1)	Crinoidal limestone to water's edge	3 "

The beds from 1 to 7 constitute the crinoidal or encrinital limestone, and from the section it will be seen that the layers vary greatly in their fossil contents. The color also varies from dark gray or bluish, to nearly white. The lighter colored varieties contain most fossils, some parts being almost entirely made up of these crinoidal stems.

The country north of Florence for four or five miles, between Shoal and Cypress Creeks, is quite broken, and consists of a mixture of barrens and red lands.

The town of Florence though resting immediately upon St. Louis Limestone, has the underlying Lower Siliceous rocks not very far below the surface, as is shown by their outcropping on all sides near the bottom of the first hills.

In some places these rocks show well the effects of weathering, where by the removal of all calcareous matter a porous mass of chert is left.

These bedded cherty rocks are seen all the way along the road from Florence to the bridge across Cypress. Cypress, for four or five miles above the bridge, and for about one below it, is very crooked. Winding along a deep, narrow gorge, with steep, precipitous gaps along its sides, it presents, in many places, picturesque sights. There is very little bottom land on Cypress or its branches.

The road, from within a mile or so of Cypress Creek, to within about three of Bluff Creek, runs along near the irregular southern edge of this Lower Siliceous formation, crossing narrow strips of barren lands alternating with the red lands of the Upper Siliceous Group. Oakland is situated near the dividing line, the country north of it being principally barrens, though containing many red hills, lying out in old sedge fields; south of it, are mostly red lands, though, for a mile or so, many barren spots occur in the low places, covered with their native growth. The road, within about three miles of Gravelly Springs, strikes the ridges, and runs along the base of these until it ascends the high ridge bordering on Bluff Creek. This road and little valleys between these ridges, are covered with a white siliceous powder or dust, from the disintegration of the rotten, porous cherty nodules which completely cover the hill sides. As the high ridge bordering on Bluff Creek is ascended, beds of chert and a yellowish white clay, resulting from their disintegration, may be seen.

These ridges trend in a direction a little west of south, and they extend down to within one-half of a mile of the river. From these ridges westward, the country might be said to be composed entirely of the rocks of this Lower Siliceous formation. One or two miles up the river, from the most easterly of these ridges, commences a cliff, which extends along the river some two miles. This cliff is about one-half of a mile from the river, and is the dividing line between the first and second bottoms. From out of this cliff, at Chandler's ferry, flows the Cave Spring, already

mentioned. The entrance and room of this cave, as far as could be seen, was about six feet high. There were two principal openings of fifteen and twenty-five feet respectively, separated by a pillar. The roof of the cave is supported by many natural pillars. During the summer months there is a constant stream of very cool air from within outward. This stream of cool air, on a hot day, can be felt ten feet from the mouth of the cave.

It is said that the cave has been explored to a distance of two miles from the entrance, and that it contains many beautiful stalactites and stalagmites.

The rocks exposed in the bluff are as follows, beginning above:

Section at Cave Springs.

(6) Loose cherty fragments forming surface............	15 ft.
(5) Cherty limestone, only partly exposed................	4 "
(4) Ecrinital limestone: a light colored, highly fossiliferous limestone, disposed in beds of varying thickness, separated by thinner beds of shaly, siliceous, and dark gray non-fossiliferous limestones	70 "
(3) Chert and cherty limestone, both shaly.............	4 "
(2) Light gray fossiliferous limestone....................	2 "
(1) Shaly limestone also fossiliferous, water's edge.....	4 "

The cave is excavated from the rocks Nos. 1 and 2, which form also the pillars alluded to above. The roof of the cave is formed of No. 3.

The valley of Bluff Creek is very narrow, with its high borders gapped by many deep ravines. Its direction is north and south until it reaches Gravelly Springs P. O., when it is changed to the west. Near where the course of the creek is changed, a cliff is exposed, with the following rocks:

Section near Gravelly Springs P. O.

(4)	Loose fossiliferous chert imbedded in soil—surface	30 ft.
(3)	Crinoidal limestone, light gray and blue above, white below	45 "
(2)	Bedded chert	3 "
(1)	Dark gray limestone, changing above to light gray	40 "

The spring flows from just under No. (1). About midway of this bluff is a cave, the mouth of which has been sealed up, and it is now used as a cool house; for fresh meats, etc. Springs are very numerous all along the course of Bluff Creek. From Gravelly Springs, the road to Waterloo passes over ridges and through small coves for about four miles, when it strikes the second bottom of the river, continuing in this second bottom until within two or three miles of Waterloo, when it strikes the ridges again and keeps along the foot of these on to Waterloo. These coves were once fine lands, but are now much worn by constant cultivation in cotton. The basin of the Tennessee on the north, in this vicinity, including both first and second bottoms, varies in width from one-fourth to three-fourths of a mile. The ridges on this side of the river slope off gradually, but, on opposite side, they end with bluffs overlooking the stream. At the foot of the hill below the town of Waterloo, some eight or ten feet are exposed of a hard, cherty, dark blue limestone regularly stratified, the same rock as that at Muscle Shoals. The valley of the Tennessee at Waterloo is about one-half a mile wide, and this average width is maintained up to the Tennessee line. The county, west from Second Creek is very much broken, indeed, so much so as to render roads impossible across it. The valley of Second Creek is very narrow and very much eroded, covered in many places with heaps of pebbles. It has a very rapid current, and during high water it is considered very dangerous to cross it. The road runs along the eastern edge of the valley and is covered with chert and iron conglomerate from the ridge above. Between two

and three miles from the State line, along the bed and banks of the creek, a stratum of dark grayish blue shaly and cherty limestone was seen.

At the mouth of "Luster Hollow" the valley of Second Creek is not more than three hundred yards wide.

In this Hollow, about a mile from its mouth, there is a cliff some seventy-five feet high, made up of highly fossiliferous chert so deeply stained and impregnated with iron oxide, as to form in some places a poor iron ore. This cliff resembles, in many respects, exposures of St. Louis Limestone. Near the head of this Hollow some fine timber is still standing.

(2). *Upper Siliceous, or St. Louis Limestone.*—No *bedded* rocks of this formation were seen in this county, the only traces of it being found in occasional pieces of impure limestone and cherty nodules. These pieces of limestone occur intermixed with the red clay resulting from their disintegration; and the fossiliferous chert, often porous and spongy, is principally seen covering the knolls and ridges. What we have said, in a general way, of these rocks and the country formed by them, will answer in all particular cases for this county.

Stratified Drift or Orange Sand.—On top of the high ridge bordering upon Bluff creek on the east, there was seen a thick bed of gravel, underlaid by a stratum of red clay. All along the road running along the eastern edge of the valley of Second creek, and along the northern edge of "Luster Hollow," there were seen fragments of Iron conglomerate, consisting of rounded pebbles held together by Iron oxide, fallen from the ridges above. These pieces were sometimes several feet in diameter. On the high level country, between the head waters of Bluff creek and those of Luster Hollow, there occur scattered beds of gravel and sand of this geological age.

LIMESTONE COUNTY.

Boundaries and Area.—This county lies between the State of Tennessee on the north and the river Tennessee on the south, and the county of Madison on the east and that of Lauderdale on the west. It contains an area of about 600 square miles or 38,400 acres.

Drainage.—The Tennessee River, forming its southern boundary, receives either directly or indirectly every drop of water that falls within its limits. In conformity with geological structure, the surface inclination is towards the south, and in this direction the streams, consequently, all flow. There are few counties in the State that have a better system of drainage; almost every square mile of its territory has a creek, and every township two or more of its larger streams, thus affording, in all quarters, an abundant supply of water. The eastern portion of the county is drained by Limestone and Piney creeks, and their tributaries. Both of these creeks rise just within the State of Tennessee, in the great east and west divide, for this portion of the State, between the Tennessee and Elk Rivers, composed of the highlands of Tennessee. These two creeks near the State line are nothing more than little rivulets, of perfectly clear water, flowing rapidly over gravelly bottoms. After becoming large streams, they both flow southerly and nearly parallel, about four miles apart, through more than half the length of the county, before they commence to converge, finally coming together in about two miles of their common mouth. Limestone being the larger, Piney might be termed a tributary of it. Limestone is also the more easterly of the two.

The central portion of the county is drained by Swan

Creek and its tributaries. This creek is smaller than either of those just mentioned. It rises in the northern portion of the county, rather south of the great divide above spoken of, and flowing southerly to within a few miles of its mouth, is deflected to the southwest, emptying into the Tennessee. The great water course for the western portion of the county is Elk River. This river rises within the State of Tennessee, entering Alabama near the middle of the northern boundary of this county, by a deep, narrow valley, cut down through the "barren" rocks, forming the divide above spoken of. Flowing in a general southwest direction, along a tortuous path through the county, it strikes the western boundary about seven miles from its mouth, below this point, forming the boundary itself. Near its central portion, it receives its greatest tributary in this county, Sugar Creek. This creek may be said to drain all that portion of this county west of Elk River. Rising in Tennessee, it enters Alabama near the northwest corner of the county, and flowing thence southeast until it empties into Elk River, it divides that portion of the county west of Elk River into two nearly equal parts. The eastern tributaries of Elk River within this county are many and small. Besides those already mentioned, there are other minor streams which help to drain the southwest portion of the county, between Elk River and Swan Creek. They flow nearly south, and empty immediately into the Tennessee.

General Configuration.—Much of the variety in the surface features of this county, as well as of all North Alabama, is due to the great denuding power of running water. But for this agency, as in Lauderdale county, so here, there would not have been a single ridge or valley, hill or hollow, within its confines. As it is, there is not a single mountain in Limestone county, and off from the creeks, very few hills and ridges. With the great highlands of Tennessee on the north, and the great water courses of North Alabama on the south, and with entirely different geological formations in its

northern and southern parts, that on the north being but little affected by the agencies which would waste away the other, and with a slight dip of the rocks to the south, it is but natural that the surface of this county should slope towards the south. This northern portion is the *true highlands*, the highlands of Tennessee, and the southern portion the lowlands, or the red lands. Each of them has impressed upon the surface its peculiar characteristics. A line drawn from about the centre of the eastern boundary of this county to its southwest corner, would mark the limit between the highlands and lowlands as nearly as could be done by a straight line. The highlands would be all north of this line, and their area would be about twice as great as that of the lowlands south of it. The general elevation, the rocks, the soil, the trees; in short, the physical features generally, distinguish clearly enough these areas from each other, though the passage from the one to the other is here more gradual, and less sharply defined than in Lauderdale county, since the southern edge of the highlands is not so much cut up into ridges and hollows. The average elevation of these highlands must be about 800 feet above Mobile bay, and some 200 feet above the lowlands. The western portion of this county is considerably more broken than the eastern, by reason of the deep, narrow ravines of the short tributaries of Elk river. The position along the dividing line between highlands and lowlands is more broken than that either north or south of it. The creeks of the western portion of this county, within the highlands, like those of Lauderdale county, are generally confined to deep and narrow gorges, but, as we go eastward, their basins become shallower, with gently sloping sides, and in these shallow basins, large, fertile areas, enclosed by a high rim, are not uncommon. The surface-rocks of these basins are the lower rocks of the "barren" group. Taken all in all, the bottom lands of the highlands form a very small per centage of the whole area. As any of the streams are approached, the country becomes

more broken, and in case of the larger ones, bordering hills and ridges are encountered, furrowed and cut up in the usual manner. These hills, with their rich, red soils, produce well; but, like all the hills of this class, they are steep; cultivation is necessarily shallow, and the loose surface-soil is liable to be washed away by every freshet. Like all the streams within the highlands, these have clear waters, rapid currents, and rocky bottoms, either of loose pebbles or of bedded rocks. They are often bordered by bluffs which are natural sections of the rocks through which they have cut. As we go eastward, the red fertile spots of calcareous soils within the "barrens" increase both in extent and in number, being more numerous here than in Lauderdale, and more so in the eastern portion of this county than in the western. The "barrens" or highlands of this county, as a general thing, still support their native growth, and it is only in the creek bottoms and a few other localities that it has been cut down. The lowlands are reached from the highlands, usually, especially in the eastern part of the county, by a very gentle descent. These lowlands have a plain-like appearance, are somewhat rolling, with here and there slight elevations, gently rounded and affording agreeable variations of the otherwise rather monotonous scenery.

In this county the lowlands are included in a right-angled triangle, having the Tennessee river for its hypothenuse and the southern half of the eastern boundary of the county for its base; their limits are pretty well defined; they extend from the Tennessee on the south to the highlands on the north, and comprise, an area of about 125,000 acres. The northern boundary though usually distinct, is very irregular, forming great and sharp curves. The average height of the lowlands is 600 feet above the gulf of Mexico. Bedded rocks within this area are seldom seen and then only along creeks, or upon knolls, and ridges, The rocks of the highlands sometimes extend down into the lowlands, along the creeks, for several

miles; nearly the whole of this area is now in a state of cultivation, a small portion being occupied by the lakelets and marshes bordering upon the Tennessee river, and a small portion along some of the creeks by the bottom lands subject to overflow, and a still smaller portion by the rocky points on some of the hills and ridges. The streams winding along through these lowlands, recognized at a distance by the line of trees which follow them, are approached by gentle descents, and often have their bottoms covered with pebbles. The lakelets and marshes, above spoken of, are surrounded by their native growth, but, with the exception of these lakelets, the creek banks, and an occasional grove covering a knoll, there are no woods found within the lowlands. Of the ridges in these lowlands, the only one of any prominence in the county is known as "Nubbin ridge," from its comparative sterility of soil. It is a high, broad and long ridge. It must be at least 75 feet above the average level of the surrounding lowlands; it is rolling or flat on top, varies in width from one to three miles, and extends along the eastern border of the county, in an almost due north and south line from the "barrens" on the north to within about four miles of the Tennessee on the south. It is not altogether, though mostly, within this county, a part of it being in Madison, the dividing line between the counties running along its top. Unlike most of the ridges of the same origin, but few of the loose cherty fragments cover its surface. It is now mostly lying out in old fields, grown up in bushes, etc., and many of these fields are deeply cut with gullies. There are some few spots upon the ridge of seemingly fair cotton land. On account of its pure water and atmosphere, and delightlul climate, this was once the place of residence of planters whose farms were situated in the more productive, though less salubrious, lowlands.

Scarcely aay traces are now left of these residences.

Soils.—The soils of this county are of the same two characteristic varieties, already described, the light gray or yellowish

gray siliceous soil of the highlands, and the red and loamy soil of the lowlands.

Springs.—Springs are numerous throughout this county, many of them of large size though they are not altogether so numerous or so large as those of Lauderdale. They are seldom met with along the level plains, either of the highlands or lowlands, but are most frequently seen flowing out from the banks and cliffs bordering the creeks and ravines. "Nubbin ridge" is especially noted in this respect; all along its sides, and at the heads of the ravines which cut into it, are to be found fine springs of pure water. In the northern portion of the county, along the outcroppings of the Black Shale formation, mineral springs, principally of Sulphur and Iron, often occur. The two best known of these medicinal springs are Sulphur springs, on Sulphur creek, some seven miles north of Athens, and Woolley or Milhous springs, in the northeastern portion of the county, on a small branch which empties into Little Limestone creek, and also on the Huntsville and Elkton road, some six miles south of the state line. These are both Sulphur springs, and were once noted summer resorts, though the former is now entirely abandoned and the latter, though still frequented, is fast following in its footsteps. Chalybeate springs nearly always accompany these Sulphur springs, running out of the same geological formation.

Forests.—The native growth of this county is about the same as that of Lauderdale. Its wooded lands are confined to nearly the same localities, though rather more abundant than in Lauderdale. There is also considerably more cleared land within the highlands in this county; the soil of the higher plains, being of a somewhat better nature, and the bottoms of much greater extent.

GEOLOGICAL FORMATIONS.

1. General Description.

The geological formations which occur in this county are the same as those of Lauderdale county, though no regular beds of superficial drift were seen. The rocks of these different formations were also very similar to those of the last named county, both as to quality and respective distribution, hence there remains but little to be said on this point.

Silurian and Devonian.—These rocks though of a very limited extent in this county, are still more numerous than in Lauderdale. They extend farther south, and down to a certain latitude are found on all the creeks, branchs, and ravines from the eastern to the western boundary of the county. Their average southern limit is about six miles south of the State line, though along the larger streams, such as Elk river, and Limestone creek, it is considerably further south. The Silurian rocks, represented by blue and gray limestones, often shaly, are exposed, along the deep valley of Elk river, as it enters the State, in beds of nearly one hundred feet thickness: everywhere else, their thickness is only a few feet. The Devonian rocks, represented by black shale and a dark, fine grained sandstone, were seen varying in thickness from one foot, to ten or twelve. The Black shale is known throughout this section of country as the "slate rock"; it occurs with great homogencity, thinly laminated, splitting up into small flakes, which strew the ground wherever it is found. It has a strong bituminous smell, especially when freshly broken, the fresh surface being of a very dark brown or black color, but becoming, on weathering, from presence of iron pyrites, a dirty reddish brown. No fossils were observed in it.

Sub-Carboniferous.

(1). *Lower Siliceous or Keokuk.*—Although the different beds composing this formation, presented in no two localities the same relative order of superposition, still they could

always be easily recognized, by their general appearance, especially by the thin seams of flint or chert. These flinty seams varied in thickness from a few inches to as many feet; they were more regular and persistent in their occurrence than any of the other rocks of the formation, though in places they were seen passing gradually into a white siliceous clay, and in others, into a yellowish white, fine grained, soft sandstone, and in still others, into a shale. It is from the disintegration of these cherty or flinty portions that the light gray soil of the barrens has been derived.

(2). *Upper Siliceous or St. Louis Limestone.*—No bedded rocks of this formation were seen in the county, though doubtless they may be found in the bluffs near the Tennessee river. Their thickness in this county is not likely to be very great, probably less than one hundred feet, since within two or three miles of their northern boundary, rocks of the underlying formation, exposed in the gullies and ditches, were not more than five feet below the surface; and eight or ten miles south of this limit, not more than fifteen or twenty feet, as shown in the wells. The cherty nodules appear, as a general thing, to be more fossiliferous than the remaining purer portions of the limestone; being often nothing more than a mere mass of fossils, held together by siliceous matter. The fossils, themselves, are often cherty or flinty. On weathering, these cherty nodules become frequently, mere cellular masses, the fossils being entirely removed leaving their casts or impressions in the chert. The hills and ridges of the lowlands owe their existence to the protection afforded by these cherty portions of the limestone.

The only two towns within the county, namely: Athens and Mooreville, are built upon this formation. Athens, the county seat, surrounded by barrens on all sides except the southeast, is on the north or "barren", side of the general dividing line between the highlands and the lowlands, but is upon a narrow strip of red land running up from the southeast. Mooresville, built on a slight, red, cherty knoll on the

east bank of Piney creek near its confluence with Limestone, is situated near the heart of these lowlands.

2. Details and Sections.

Silurian and Devonian.—The most southern point at which these rocks were seen in this county, or rather in this section of the State, was in S. 35, T. 2, R. 6, west, some seventy-five yards north of the Elk River Mills, on Blair's Ferry road, in the bed of a dry branch of one of the small ramifying ravines, of a larger one belonging to Elk River. They doubtless do crop out in spots south of the above locality, but of such out-crops we have no personal knowledge. The rocks at this place formed a small cascade in the branch, the bed of which, both above and below, was thickly covered with loose rock. The bedded rocks here seen, were as follows:

Section on Elk River.

Devonian.	(3).	A reddish-gray, fine grained sandstone, covered with loose rocks, upper stratum of the cascade....	18 in.
	(2).	Black Shale	2 ft.
Niagara.	(1).	A blue limestone, forming bottom of little cascade, only the top of it showing.	

These rocks seem to have a slight dip to north-west; no other bedded rocks were seen near them, the slopes of the ridges on each side, being covered with loose rock, principally chert. The nearest place to the one just mentioned at which they were next seen, was in S. 18, T. 2, R. 5, west, (and hence, some three miles north-east,) on the east side of the river, nearly opposite the mouth of Sugar Creek, on a little branch just west of the residence of Mr. Jno. Beasley. They occurred along the bed of the branch for a distance of half a mile, and the lowest of them must be about fifty feet above the river.

The rocks here exposed were as follows:

Section near Elk River, Opposite mouth of Sugar Creek.

Lower Siliceous.	(9). A loose conglomerate of fossiliferous, cherty pebbles.	
	(8). A plastic yellowish white clay, disintegrated chert, containing fossils	1 ft. 6 in.
Devonian.	(7). A grayish-blue shale, completely decayed where exposed, called by the people "soap-stone," or "young slate."	1 ft.
	(6). Black Shale, finely laminated, splitting up into large, very thin sheets	3 ft.
	(5). A dark gray, shaly, fine grained sandstone	6 in.
	(4). Black Shale	4 in.
	(3). Same as (7)	6 in.
	(2). A dark gray, fine grained sandstone	2 ft.
Niagara.	(1). Shaly, gray, variegated, and dull colored limestones, regularly stratified	35 ft.
	Loose rock.	

These rocks seem to have a slight dip to south-west, which, taken in connection with the northerly dip of those previously mentioned, shows undulations in the strata.

The same rocks were also seen in the spring branch just in front of Mr. Beasley's house. Just south of this out-crop, and, I believe, just overlying it, are the high cliffs of ecrinital limestone to be hereafter mentioned. From here on to the State line, this Black Shale with its underlying rocks are exposed along nearly all the creeks and ravines. Some five or six miles north-east of the last named locality, on Redus' Creek, for a distance of three quarters of a mile up the creek, from the mill, the following rocks can be seen:

Section on Redus' Creek.

Lower Siliceous.	(1). A light gray, cherty limestone, with thin seams of chert	15 ft.

Devonian.	(6). Black Shale	2 ft.
	(5). A soft, yellowish sandstone, turning below to a hard, compact rock, containing in spots much iron pyrites, and in others particles of mica	4 ft.
	(4). Black Shale	8. in.
	(3). Grayish-blue shale, so-called "soap-stone."	
Niagara.	(2). A coarse, gray fossiliferous limestone.	
	(1). A blue, fossiliferous limestone.	

No. (2) Forming the surface rock around the mill.

No. (1) Seen in creek below the mill; and,

No. (4) Seen in a little ravine, by side of the road, leading down to mill, from a westerly direction.

These rocks seem to have a slight dip toward to northwest. Near the school house, on the road leading up to Mr. Leggs' S. 26, T. 1, R. 5, west, were seen three or four seams of this Black Shale, varying in thickness from two or three inches to as many feet, and separated by thin seams of the fine grained, dark sandstone, and capped with a cherty conglomerate. These rocks dipped to southeast. Higher up this road, at least thirty feet above the last named conglomerate, the Black Shale again made its appearance, here intermixed with a yellow sandrock, sometimes grayish. becoming shaly towards top and very fossiliferous. The Black Shale as seen here in this road, was very tough, compact, and flexible, splitting up into very large sheets.

At Mr. Leggs' spring the following rocks were seen:

Lower Siliceous.	(9). Clay and loose chert overlying a fossiliferous limestone.	Thickness undetermined.
Devonian.	(8). Sandstone	4 ft.
	(7). Black Shale	4 ft.
	(6). Grayish-blue shale	3 ft.
	(5). Seam of chert	3 in.
	(4). Earth, strata not seen	10 ft.
	(5). Same as (6)	3 ft.

Niagara.	(2). A yellowish looking, magnesian limestone........................	4 ft.
	(1). A variegated, siliceous looking limestone.	

These rocks must be some sixty or seventy-five feet above the river. Throughout the northern portion of the county, Elk River winds along a deep valley, from one to one and a half miles wide, bounded by high hills and ridges. These ridges and hills gradually slope off to the bottom lands below, and the lowest, or those nearest the river, present near their bases exposures of a light gray, siliceous, fossiliferous limestone. This limestone often contains brownish-red and blue spots, and becomes shaly or flaggy near the top of the slanting hills. Where the rock is shaly or laminated the surface is very rough and rugged, being covered with large slabs. Such spots are often overgrown with cedars. Farther from the river, back in the hills, the rocks overlying those just mentioned, are seen. Near the base they are light bluish-gray, siliceous, shaly limestones, lying in ledges, and (when appearing near the top of a hill or ridge) covered with loose chert. Still higher up, and farther back in the hills, there is seen a dark blue siliceous, fossiliferous limestone, covered by a soft, light, magnesian limestone. The light gray massive, shaly, and laminated siliceous limestones on the sides of the hills and ridges nearest to the river, are probably of the Nashville formation, Lower Silurian, whilst the rest are of the Niagara group, Upper Silurian. The soil of the comparatively level tracts of land lying along the river, formed from the disintregation of these lower siliceous limestones, appears to be very fine. The Black Shale crops out all along on the sides of the hills and ridges farthest back from the river, but in no place was it seen exposed to any considerable extent. It is believed by many of the inhabitants to indicate stone coal, and in more than one place, trial pits have been dug in search of coal. At the crossing of Sulphur Creek, so called from the springs which occur on it,

near the Athens and Pettusville road, the following rocks are exposed:

Section on Sulphur Creek.

Lower Siliceous.	(10). Soil, top.	
	(9). A yellowish, sandy-looking clay, disintegrated chert	3 feet.
Divonian.	(8). Black shale	4 "
	(7). Soft, grayish blue shale, so-called "young slate"	2½ "
	(6). Soil and loose rock—strata not seen	3 "
Silurian.	(5). A very fossiliferous, grayish blue, siliceous limestone	18 in.
	(4). A deep blue fossiliferous limestone	18 "
	(3). A dirty looking limestone, containing shells, shaly below	10 "
	(2). A deep blue limestone	18 "
	(1). A gray limestone	10 *feet.*

The dip of these beds could not be determined. The Black Shale was also seen in the northeastern portion of the county, on Limestone creek, at the ford on the Huntsville and Elkton road, both in the creek and on the northern bank, in a seam some ten or twelve feet thick. The same rocks are said to occur some five or six miles down the creek, below this crossing. They are the rocks from which flow Milhous or Woolley Springs.

Sub-Carboniferous.

(1). *Lower Siliceous or Keokuk.*—The road from Huntsville to Athens, within the limits of this county, runs along near the southern edge of this formation, being partly over beds of this age, and partly over those of the St. Louis limestone. Near Piney creek, regular beds of stratified chert were seen in the road, weathering in places to a fine grained, soft sandstone, and in others, to a white siliceous clay. These strata were from ten to twelve inches thick. Separating Piney and Swan creeks is a slightly elevated ridge, composed principally of cherty pebbles, extending some two miles south of the above road. On Limestone creek, a large

basin, from three to four miles broad in all directions, has been formed by the removal of the siliceous crust forming the "barrens." In some places the rocks, it is said, have been cut through down to the underlying Black Shale. The lands of this basin were once very fine, but now they are much worn, and there are many old fields lying out in sedge grass and bushes. The country along Limestone, north of this basin, is very much broken. On Little Limestone, half a mile above Woolley Springs, there occurs a low bluff of cherty, argillaceous, dull-colored limestone, highly fossiliferous, and the loose cherty nodules covering its hill-sides were little else than masses of shells and other fossils. No Black Shale has been noticed on this creek, though it occurs all along Big Limestone. Forming the bed of a dry branch, just north of Buck-eye road, near Athens, was a cherty conglomerate, made up of fossiliferous chert, held together by iron oxide. Along the road from Athens to Brown's ferry, within the "barrens," there occurs some fine timber. On the hill-sides, regular strata were observed of slightly fossiliferous chert, weathering into a soft yellowish, argillaceous, siliceous mass. Angular cherty pebbles are abundant along this road. On the Mooresville and Fort Hampton road, near the crossing of Poplar creek, the cherty rocks of this foundation were seen in gullies in regular strata, overlaid by four or five feet of red earth. The river hills extend out from Elk river about a mile and a half. They are considered very productive, but not good for cotton on account of liability to rust. By many, who have faith in the "divining rod," these hills are believed to contain ores of the precious metals. Of course, no one with a trace of geological information, would look for such ores in this position. In the little ravines, separating these hills, many fine oaks and poplars are to be seen. The Blair's Ferry, or Elk River Mills road, from Rodgersville, soon after entering this county, strikes the river hills, and thence on meanders along the narrow valleys with fertile soils. The sides of these valleys are often made

by cliffs of fossiliferous and shaly cherty limestone, from which flow many fine springs. Just beyond Lanceville, on the Elk River Mills road, large blocks were observed, ten or fifteen feet square, of the siliceous limestone of this formation. Along the eastern bank of Elk river, both above and below the mill, are very high cliffs of crinoidal limestone, at least 125 feet above the river, though about 60 feet of this height, at the base, were hidden by earth and debris. These cliffs were very similar in appearance to that seen on the western bank of Blue Water at the State line. The crinoidal limestone was exposed here in greater thickness than at any other locality examined. These bluffs are not continuous, but are separated by deep, narrow gorges, down which flow the short, rapid streams. The country above the cliffs was comparatively level, the soil red and fertile, though of no great depth, as shown by the cherty rocks in the gullies.

The Athens and Pettusville road to about the sixth mile post from Athens, passes, for the most part, through the "barrens," covered principally with a growth of short-leaf pine, though, in spots, some good sized white oak trees are found. The few scattering oaks that were originally intermixed with these pines have mostly been cut out, leaving an undergrowth almost entirely of dwarf oaks. The little hills within these barrens are covered with cherty pebbles. Between the sixth and eighth mile post, on Sulphur creek, this road passes through a large body of red land, probably derived from the disintegration of the lower rocks of this formation. In the portion bordering upon Sulphur creek, this red land has been washed into huge gullies.

(2). *Upper Siliceous, or St. Louis Limestone.*—The rocks of this formation make the county, between the lower limit of the "barrens," as above laid down, and the Tennessee river. This part of the county is generally under cultivation, and what has been said upon this head in the general description above will suffice, since no detailed sections of the St. Louis beds have been obtained.

The long, narrow lakelets bordering upon, and parallel with, the Tennessee, in the southern part of the county, form a somewhat peculiar topographical feature. These bodies of water are seldom more than a mile and a half from the river. Occasionally they are doubled, the outer, in such cases, being usually connected with the river at both ends, the inner communicating with the river at one end only.

MADISON COUNTY.

Topography, Etc.

This county, together with Limestone, occupies the central portion, in an east and west direction, of the section under consideration. It lies between the State of Tennessee on the north, and the river Tennessee on the south, and between the county of Jackson and Paint Rock River on the east, and Limestone county and the Tennessee River on the west. It thus comprises an area of nearly 800 square miles or more than 500,000 acres. Its southern boundary, being formed by the Tennessee River, flowing in a general north of west direction, is by no means straight, the river along this portion of its course, being especially crooked and considerably north of its general direction. Reaching up into the county by two large bends, it causes the eastern border to be some eight miles and the western some three miles broader, from north to south, than the central portion. The eastern boundary of this county is also very crooked; that portion of it bordering upon Jackson county being made to run, principally, along the top of the great divide between the waters of Flint and Paint Rock Rivers, and the rest of it being formed by Paint Rock River itself, a very crooked stream.

Drainage—As Madison county is upon the southern slope of a great water shed, all the streams of the county flow southward into the Tennessee River.

Flint River is the principal stream flowing through Madison, and together with its tributaries, it drains two-thirds of the county. Below its confluence with Hurricane Fork, twenty miles from its mouth, it receives no tributary of any considerable size; but above this point in the northern half of

the county, it spreads out by means of its tributaries, Barren Fork, Mountain Fork, Brier Fork, and Hurricane Fork, and embraces within its drainage area nearly the whole width of the county east and west. Of these streams the two largest, Barren and Brier Forks, are western tributaries; the other two are eastern. Barren Fork, the largest of them all, rises in Tennessee, and, entering this county near the middle of the northern boundary, flows southeasterly, for the most part along "barrens," for some twelve miles, where it meets with Mountain Fork. The latter having its sources, principally, in the springs of the narrow fertile valleys lying between the mountain spurs of the northeast corner of the county, flows a general southwesterly direction, or nearly at right angles to Barren Fork, until the two come together. It is bordered throughout the most of its course by rich lands.

Flint River, proper, below the confluence of these two streams, has a general north and south course to its mouth, a distance equal to three-fourths of the length of the county in this direction.

Brier Fork, rising in the central portion of the northwest fourth of the county, in the "barrens," keeps a general southeasterly direction, and hence runs more or less parallel to Barren Fork and about four miles distant from it, until it empties into the river some five miles below the confluence of Mountain and Barren Forks. It receives its greatest tributary, Beaver Dam Creek, about three miles above its mouth.

Hurricane Fork, the smallest and most southern of the above named streams, has its sources in the narrow valleys between the mountain spurs of the eastern edge of the county. This stream runs for the most of its length in a southerly direction, along the eastern border of the county, through narrow fertile valleys, emptying into Flint, as we have already said, about twenty miles above the mouth of the latter. From the confluence of Hurricane Fork to its own mouth, Flint River flows between the spurs and moun-

tains of the Cumberland range, with a bottom of an average width of about three miles.

The next in importance to Flint River though it drains only about one-fourth of the area, is Indian Creek. Indian creek, proper, reckoned from the fork of Price's Creek and the Huntsville Spring Creek to its mouth, is only a few miles in length. Its greatest tributary, Price's Creek, commonly goes by the name of Indian Creek. Through its branches this Creek drains all the southwestern fourth and most fertile portion of the county. Its principal tributaries are Price's Creek, Huntsville Spring Creek, and Barren Creek. Price's Creek, the largest of these, takes its rise in the large springs near the central portion of the western half of the county, and flows an almost due south course until it meets the Huntsville Spring Creek some two miles from the Tennessee River.

The Huntsville Spring Creek, supplied by the *big springs* in and around Huntsville, (as the Huntsville spring, Brahan's spring, &c.,) flows generally southwest to its confluence with Price's Creek. Both of these creeks are fed along their lengths by *big springs*. Indian Creek, below the confluence of the two above named streams, runs a little west of south, until within about one-fourth of a mile of the river when it is deflected to the west, following the river and parallel to it, something over two miles, to the town of Triana, where it empties into the river. Barren Creek, the only other tributary of Indian Creek, of any size, and also the smallest and most westerly of the three mentioned, takes its rise partly in this county, and partly in Limestone, in the springs along the eastern edge of *Nubbin Ridge*, northwest of the town of Madison. It flows into Indian Creek about one mile above the mouth of the latter.

We have thus seen, that Flint River and Indian Creek, with their tributaries, leave but little of this county to be drained by other streams. A small portion along the western border of the northwestern corner of the county, is drained by the

head waters of Limestone Creek, a still smaller portion, in the southeast corner, by Paint Rock River, and another small portion, lying between the Huntsville meridian and the Huntsville mountain, by Aldridge Creek.

General Configuration.—As many of the mountain spurs and isolated peaks, in which the great Cumberland plateau ends, are within the limits of this county, the scenery is greatly varied. The rim of the monntain plateau in the eastern part of the county, is of very irregular outline, being deeply gapped by numerous coves.

In the western part of the county, the surface is undulating or rolling; high and broken in the northern portion, and generally low and flat, with occasional mountainous elevations on the south.

All these irregularities of surface are due solely to the denuding power of water, as the horizontal bedding of the rocks testifies.

From many of the elevated points, the views are grand.

This county can, perhaps, best be described by dividing it into four parts by lines running north and south, and east and west.

The Northeast Fourth.—This quarter is drained by the four forks of Flint River. It is mountainous on the east, with barrens on the north, and level and rolling country in the central and southwestern portions. The spurs of the mountain on the east extend westward four to eight miles from its eastern boundary. The narrow valleys between these spurs are fine lands, and down them flow the numerous small streams forming the head waters of Mountain and Hurricane Forks. The barrens on the north as a body extend down into the fork between Mountain and Barren Forks, and *in spots* are found throughout this whole division, especially along the creeks and low places. West of Barren Fork, away from the creek, in this division, there are no barrens of any consequence. Along Barren Fork, and east of it,

there is much low, flat, swampy land of this kind. East of Hester Creek, the largest tributary of Mountain Fork, and especially adjacent to the creek, the country is very broken, and with little or no bottom land.

The rolling red lands of the central and southwestern portions of this division, extend up the Huntsville meridian, almost to the State line, and along the foot of the spurs of mountain on the east, they form a narrow strip, clear through to the Tennessee. Not very far to the north and east of the center of this division, is the town of New Market, situated on Mountain Fork, and surrounded principally by the rolling lands above named.

Northwest Fourth.—The eastern half of this quarter is drained by Brier Fork, and its largest tributary, Beaver Dam Creek, and the western half, by the head waters of Limestone Creek. A line drawn from the northeast to the southwest corner of this division, would separate it into two equal portions, very unlike in all particulars. That on the north or northwest side of the line, would consist for the most part of "barrens" or highlands, with very rough and broken surface; that on the south or southeast side, principally, of the red, rolling lands or lowlands, as heretofore designated, with an occasional barren spot near the dividing line, and a few mountain ridges and peaks in the southern portion. Along the Huntsville meridian, as already stated, these red or rolling lands extend up to the State line, and between the head waters of Limestone and Beaver Dam Creeks, they extend up into the "barrens," forming the divide. The peaks of the southern portion are more or less round, and about one mile in diameter. Many of the smaller ridges, though mountainous, show no bedded rocks at all. They are covered with small, loose, cherty fragments, embedding occasionally, near the top, large masses of limestone.

On these summits, limesinks and ponds are sometimes found.

The land at the bases of these spurs and ridges, and in the valleys which separate them, is usually quite fertile.

Southwest Fourth.—This quarter is drained entirely by Indian Creek and its tributaries. In a general way, it is high and rolling on the north, and low, flat, and gently undulating on the south. The isolated mountainous peaks which form a part of its surface, relieve the monotony of the scenery. In the southern portion there are lage level areas of prairie-like lands. Taken all in all, it is the most fertile position of the country, and, with the exception of the parts covered by the mountains and the low, flat, swampy lands, it is almost entirely in state of cultivation. This division is noted for its *big springs* and lime sinks. Some of the larger of these sinks near the river are supposed to be connected with the river subterraneously, since they are affected by its rise and fall. Ponds are also numerous throughout the southern portion of this division.

Southeast Fourth.—This quarter is drained almost entirely by Flint River, which flows from north to south, nearly through the center of the division.

Paint Rock River drains a small area in the southeast corner, and Aldridge Creek, a still smaller area south of Huntsville, lying between the Huntsville mountain and the meridian of that city.

In general terms, this division consists of two high mountainous areas, separated by the narrow valley of Flint River.

The eastern part between Flint and Paint Rock Rivers, has been cut up by erosion into a number of disconnected mountain peaks, whilst the western ridge which is a prolongation of the Huntsville mountain, is continuous along the summit, though much indented on the eastern side by fertile coves, which are offshoots of the Flint River valley. The detached spurs of the eastern border, are similarly separated by large fertile areas of the same nature as the main valley.

Along the Tennessee River where it forms the southern boundary of this division, the mountains are close to the river, leaving very little of the lowlands between.

When Paint Rock River has cut through these mountains in the southeastern corner of the division, its banks are perpendicular cliffs, some five hundred feet in height.

Soils.—There are three distinct varieties of soil in this county, with of course, all the intermediate grades, resulting from their admixtures.

(1) The red soil of the low lands, rolling lands, and mountain sides, derived principally from the disintegration of the St. Louis limestone.

(2) The light, gray and yellowish gray siliceous soil of the "barrens" or true highlands, formed by the disintegration of the cherty portions of the Lower Siliceous rocks.

(3) The light and yellowish gray sandy soils of the plateaus covering the tops of the mountains, from disintegration of sandstones and conglomerates of the Coal Measures.

No. (1) covers most of the county, and forms the greater part of its farming or rich lands. Though principally derived from the St. Louis Limestone, some little of it may be from the overlying Mountain Limestone, and a still smaller portion from the underlying Lower Siliceous rocks. This variety of soil forms all the low level areas, down to the Tennessee; it covers also the bases of the many mountain spurs, extending sometimes high up their sides, even covering entirely the smaller ridges. In proportion to the amount of organic matter present, the soils vary in color from the black loam of the river and creek bottoms to the deep red clay of the mountain and hill sides. The subsoil is always red. The reddish and brown varieties though generally looked upon as cotton lands are also good for nearly all the grain crops, and different varieties of grasses. The black loam of the bottoms is especially suited to corn.

No. (2) next in importance to No. (1), is confined prin

cipally to the northern portion of the county, and especially to the northwestern corner and to the country between Barren Fork and Hester Creek. Wherever this soil forms the surface, the country is, comparatively speaking, but thinly settled and little under cultivation. It is generally looked upon as poor or unproductive, but by admixture of the red clay of No. (1) and organic matter, it is improved, as is shown in those places where the two varieties of soil have been mixed by the washing from the red lands above. It has already been stated, under Limestone county, that with deep ploughing and a suitable compost, this can be made a fine cotton soil.

No. (3) the least in importance of the three general varieties mentioned, covers a very small proportion of the area of the county. It is found only along the level plateaus forming the tops of the mountains, and being also very poor, is of very little importance agriculturally.

Forests.—The wooded lands of Madison county are confined for the most part, to the high lands, or "barrens" and mountains, though they occur along the creeks and over the marshes and swamps of the low lands. The kinds of growth characterizing these different areas, have been given elsewhere.

Springs.—This county is especially noted for its *big springs* which occur in all the level and rolling areas. They are produced by the coming to light or emergence of large underground streams, and either flow from beneath small hills or bluffs, or boil up from large, deep, well-like holes, or in numerous small springs, distributed over small basin-shaped depressions which are usually covered by their waters. In whatever way they appear, they immediately run off as large creeks. The best known of these *big springs* is *The Huntsville Big Spring*, though there are others within a few miles of this which furnish equally as much, if not more water. *The Huntsville Big Spring* flows from under a bluff 50 to 75 feet high, on the brink of which, overlooking the

spring is The Northern Bank of Alabama and other buildings on the western side of the public square. From this spring, the city is supplied with water. The waters run off in a stream which in former days, was navigated by boats carrying cotton to the Tennessee River. The temperature of the water in the month of June, according to Prof. Tuomey, was 60.8° F. whilst that of the atmosphere was 80.6° F. The coldest spring water known in the State, is found on the side of Monte Sano, not very far from its top, and at least eight hundred feet above the Huntsville Big Spring. The temperature of this water in the month of July, according to Prof. Tuomey, was 55.4° F. whilst that of the atmosphere was 80.6 F. At about the same altitude as the last named spring, there occur on the side of Monte Sano, numerous small chalybeate and alum springs running from the shales overlying the thin seams of coal.

Along the outcroppings of the bituminous shale in the northern portion of the county, sulphur springs are met with. One of these situated in S. 26, T. 1, R. 1, east, was once a place of resort, but like others of similar nature, it seems to have had its day of prosperity. Its water is very strongly impregnated. The best known mineral water in the county, is that of Johnson's Well in S. 26, T. 1, R. 1, west. This water has quite a reputation for its medicinal virtues, and is visited annually by the afflicted, not only of this county and State, but also of neighboring States.

Geological Formations.

General Description.

The following geological formations make up the surface area of this county; (1) Silurian, (2) Devonian, (3) Lower Siliceous, or Keokuk, (4) Upper Siliceous or St. Louis Limestone, (5) Mountain Limestone, (6) Coal Measures.

Silurian.—Though none of these rocks were seen in this county, there is very little reason to doubt that they do appear along the creeks near the State line.

Devonian.—This formation is represented in this county by a black bituminous shale, and is confined to the creeks and branches in northern portion of county, from Hester Creek, westward. The dark, fine grained sandstone associated with the Black Shale in Limestone and Lauderdale counties, was not noticed here. This rock, (Black Shale) seems not only to have increased in thickness, as we have come eastward, but also to have become more slaty and flexible. It doubtless extends southward, down into the county, along Flint River, some eight or nine miles. It was seen as far south as the site of the old McFarland Factory, on Mountain Fork, about one mile above its confluence with Barren Fork. Thickness at least ten feet.

Sub-Carboniferous.

(*1*) *Lower Siliceous or Keokuk.*—The rocks of this formation consist in this county, of flint or hornstone, a compact, fine grained sandstone, and a cherty limestone, the flint or hornstone occurring in starta from two or three, to twelve or eighteen inches in thickness. On being struck with a hammer it breaks into cubes or "diamonds" as they are sometimes called. None of the crinoidal limestones of this formation, so well developed in Limestone and Lauderdale counties, were seen in Madison. In this county, these rocks are much thinner than in Lauderdale and Limestone, and at the same time have lost many of the characteristic features, ther epresented. They are co-extensive with the "barrens" and hence, with few exceptions, especially along the creeks, are confined to the northern portion of the county. Along the creeks they extend down into the overlying formation or red lands; and along Fint River as far as the central portion of the county. The country formed by them is as a general thing much broken.

(*2*) *Upper Siliceous or St. Louis Limestone.*—Cherty limestones and thin seams of chert make up the rocks of this formation in this county. These rocks appear to be

much more siliceous here than in the counties already described, making it difficult, in many places to distinguish them from the underlying rocks merely by their general appearance. The soil, too, derived from them, in many spots resembles very much that of the "barrens," and supports the same natural growth. These rocks are of equal extent with the lowlands or red lands. Along the Huntsville meridian, and at the foot of the mountains in the northeast corner of the county, they extend in narrow strips, through to the State line on the north, and between the head waters of Limestone Creek and Brier Fork, they extend up into the "barrens," forming the divide. They form the sloping bases of all of the mountains, and cover the whole surface of some of the smaller detached ridges. These rocks are seldom seen in undisturbed beds, being generally much disintegrated. The cherty portions of the limestones, however, usually cover the sides and tops of the knolls and hills. Big Springs, limesinks, and ponds are characteristic of this formation throughout North Alabama. Occasionally ponds are seen occupying shallow basins on the summits of the lower ridges of this section of the county.

Upon this formation all the towns in Madison county have been built. The average thickness of these beds in Madison is about 200 feet.

(3) *Mountain Limestone or Chester Group.*—This formation, in this county, is made up of various shades of blue, gray, and dull colored limestones, argillaceous and shaly limestones, and sandstones. They all seem to be more or less fossiliferous, and hold locally, beds of solitic crinoidal sparry and Magnesian limestons and, in a few instances, thin seams of chert. These rocks are found almost exclusively along the mountain sides, and covering the higher detached ridges and spurs, seldom extending down into the valleys. They vary very much in their relative positions, thicknesses, and composition; in no two places were the observed sections of these rocks identical. Whenever they

extend down into the lowlands they are at best, covered by a very thin coating of soil, being more frequently bare. The sandstones occur as a seam, or locally in several seams, separating the limestones, and usually forming a bench, or benches, along the sides of the mountains. These seams of sandstone, vary in number from one to three, and inthickness from a few feet to some twenty-five or thirty. This sandstone is known as the Lagrange sand-sandstone; it is for the most part a fine grained sandstone, often laminated, and containing impressions of coal plants, though in places it is coarse, soft and friable; besides forming the benches along the sides of the mountains, it sometimes makes the capping stone of some of the smaller detached ridges. The natural growth upon it, is so different from that of the limestones above and below it, that the lines of division can readily be distinguished at a distance. This sandstone was, in several instances, observed extending out into the fields near the base of the mountains and in the southeastern portion of the county, forming extensive level areas. The limestones above these seams of sandstone are finely displayed in the bluffs in the southeast corner of the county, near the mouth of Paint Rock River. Some of the limestones seem to be well suited to architectural purposes. Forming very little arable land, the rocks of the Chester Group are of very little importance agriculturally. They vary in thickness from 500 to 800 feet.

Coal Measures.—This formation here as elsewhere, consists of ferruginous conglomerates and sandstones, shales and coal. They occur only upon the highest lands, or mountains of the eastern half of the county. These level plateaus are covered with a poor sandy soil, divided from the sandstones and conglomerates of these measures. Upon the level summits of the mountains the underlying sandstones are often seen bare, and along the sides of ravines they usually form a line of cliffs. A similar line of cliffs, exposing often nearly the whole thickness of the formation, is generally seen around

the edge of the plateaus. Near the foot of these cliffs, the seams of shale and coal make their appearance. Along with the shale and coal, there is often a thin seam of white clay which is a very good fire clay. From these shales and sandstones, flow numerous small alum and chalybeate springs. These seams of coal vary in number from one to three separated by shales and sandstones and from a few inches in thickness to about two feet. This coal as a general thing, burns very freely, though it contains a large per centage of ash and sulphur; on account of the thinness of the seams and their inaccessibility, this coal has been mined to a very limited extent in this county; except in one place on the side of Monte Sano. The rocks of this formation, in Madison county, show a maximum thickness of 150 to 200 feet.

2. Details and Sections.

Devonian or Black Shale.—This rock is said to occur all along Big Limestone Creek in the northwestern portion of county, forming small bluffs ten or twelve feet high. This seems probable as it occurs just within Limestone county on this creek, and was seen along the Huntsville and Upper Elkton road, just north of the creek in this county in great piles, doubtless hauled from the creek below. It was also observed in a seam, on the side of a hill some ten feet above a small spring branch running into this creek, in S. 29, T. 1. R. 2, W. The shale was here about eighteen inches in thickness; no other bedded rocks were seen near it. In the northern portion of the county, in S. 17, T. 1, R. 1, E., on Barren Fork of Flint, another outcrop was observed, four or five feet in thickness. It is said to occur on all the branches and creeks near the last named locality. It forms the bed of Hester Creek and a small branch near it, where crossed by the Limestone road, in S. 18, T. 1, R. 1, E. No other bedded rocks were here noticed near it. This is probably its most easterly occurrence in this county, or in North Alabama, outside of the anticlinal valley of the Tennessee. The most south

ern point at which it was seen in this county, was on Mountain Fork, about one mile above the mouth, at the site of the old McFarland Factory. It here covers the creek bottom and sides, just above where the old dam used to stand, for some two or three hundred yards. It was here heaped up along the banks in great piles, some of the thin slabs eight and ten feet in diameter. These piles were probably made by parties in search of "coal oil." Under the water or on a freshly broken surface, this shale was almost black, but, as seen on the bank, it was reddish brown in color, from the weathering of the large quantity of iron pyrites enclosed in it. This seam must be here at least ten feet thick. No other bedded rocks were exposed near it, the creek bottom and sides both above and below, being covered with loose gravel. This rock is said to occur also in the bed of Flint River, two miles south of the last named locality.

Lower Siliceous or Keokuk.—In the eastern portion of this county the upper rocks of this division are so blended with those of the overlying formation as to make it difficult or almost impossible, in places, to separate them. In the north-western and northern portion of the county, they are seen along the creeks and hillsides as seams of chert or hornstone, regularly stratified, the strata varying in thickness from a few inches to some ten or twelve. These flinty seams were often observed weathered, into a white siliceous powder. East of Hester Creek, extending out from it for about one mile, and down it to within a mile or so of its mouth are ridges, at the bases of which are the occurrences of Black Shale noticed above. These ridges have a mulatto soil, and are covered with angular cherty pebbles, probably derived from this formation. At the confluence of Barren and Mountain Forks, in the bed of the river, is a hard, dark blue cherty limestone of this formation in strata about six inches thick. This same cherty rock occurs in the creeks and branches, and forms the shoals in the river, near the mouth of Brier Fork. At the Bell Factory, one mile below the mouth of Brier

Fork, the upper portion of these rocks is composed of a compact, fine grained sandstone with cherty seams. (See section under St. Louis Limestone below.)

Upper Siliceous or St. Louis Limestone.—The lower rocks of this formation, seem to have become more siliceous, their cherty seams more numerous and thicker, as we have come eastward. These lower cherty rocks are displayed in the bluff above the Huntsville spring, and in the bluff near the mouth of Indian Creek, above the spring at Triana. Around Huntsville, these rocks are probably about 200 feet in thickness. As already stated above, undisturbed beds of this formation are comparatively rare, the limestones having generally been disintegrated, leaving the chert in angular fragments, with an occasional block of the limestone itself, covering the hill-sides and summits, and imbedded in the red soil. On the hill-sides, especially along much traveled roads, there are places perfectly white with siliceous dust from the weathering and wear of these cherty portions. The rocks scattered throughout the town of Triana, contain seams as well as nodules of chert. In these seams are numerous specimens of the well known fossil, *Lithostrotion Canadense.* The country all around Triana, extending out four and five miles from the river, is for the most part, low and gently rolling, with extensive areas of perfectly level land and occasional low, red knolls. It is dotted all over with numerous ponds and sinks, so characteristic of this formation. Along the southwestern edge of the county, extending down to within four miles of the river, is the ridge known in its northern portion as "Nubbin Ridge." From Price's Creek, up Rainbolt Mountain, the thickness of this formation was estimated at about two hundred feet. This mountain is about three miles long, in a north and south direction, and, so far as seen, consisted entirely of the rocks of this group. Where crossed by the Huntsville and Madison road, near its southern extremity, it was comparatively flat and about half

a mile broad on top. Within a mile of this mountain on the northwest, the "barrens" set in.

In S. 32, T. 3, R. 1, W.; S. 22, T. 3, R. 1, W.; and in S. 20, T. 2, R. 1, W., are ridges, or low mountains, composed entirely of the rocks of this formation. Pond Mountain, one of these ridges, two miles northwest of Huntsville, receives its name from the fact that it has on top, a pond or lime sink.

Madison Cross Roads, properly within the "barrens," is situated on a high, level area between the head waters of Limestone and Beaver Dam Creeks, the surface of which is made by these rocks. Some of the high country around New Market, the soil of which has been derived from the more cherty portions of this formation, has very much the appearance of the "barrens," both as to soil and growth. At the Bell Factory, on Flint River, one mile below the mouth of Brier Fork, the following rocks were seen:

Section at Bell Factory, on Flint River.

Siliceous Group.	(2) Cherty limestone with layers of chert........................	20 ft.
	(1) A compact fine grained sandstone, with seams of chert,	15 ft.

In this section, it was uncertain whether the rocks belong to the upper or lower division of the Siliceous Group.

Mountain Limestone or Chester Group.—In the spurs and ridges, west of the Huntsville Mountain, where these rocks form the capping stones and have been partly removed by erosion, they do not appear in so great a thickness as in the eastern half of the county where they have been protected by an overlying formation (the Coal Measures.) Where thus protected, they seem to have an average thickness of about 600 feet. A section of these rocks, as they appear on Monte Sano, is given by the State Geologist in his report of progress for 1877 and 1878, on page 21. From the lowest part of the valley near Huntsville, to the top of Russell's Hill,

a detached mountainous spur, two miles west of Huntsville. the following section was taken:

Section near Huntsville.

(2) Mountain Limestone	(2) Shaly limestone.........100 ft. (1) Bluish gray, compact limestone.................. 75 ft.
(1) St. Louis limestone	....200 ft.

The thicknesses of the different strata, are merely rough estimates. The upper portion of these rocks are finely displayed in the southeastern corner of the county, in Flat Rock bluff, a perpendicular cliff some two hundred and fifty feet high. This bluff is formed by Paint Rock River, where it cuts through the mountain, bordering on the Tennessee. It is the conterpart of Painted Rock bluff, just opposite to it across Paint Rock River. The top of the bluff is over five hundred feet above the Tennessee, which flows at its base. About four hundred feet of this height are formed by the rocks of this formation, the rest, by the sandstones and other strata of the Coal Measures. The face of the cliff is composed entirely of limestones, the intercolated seam of sandstone being beneath the debris at its foot, and the Coal Measures slanting off from its summit. The limestones are dark blue, bluish gray, and argillaceous, in places shaly and granular. A hard, bluish gray, cherty limestone, immediately underlying the carboniferous sandstone, forms the top of the perpendicular portion of the bluff. The rocks are regularly stratified, and are stained along the perpendicular face of the bluff in irregular patches, by oxide of iron, giving them a grotesque appearance. The seam of sandstone of this formation caps the majority of the higher detached peaks and spurs west of the Huntsville Mountain, and some of the lower ones in the northeast portion of county. It forms the summit of Capshaw Mountain, which is the most western locality of the occurrence of the rocks of the Chester group in Alabama, north of the Tennessee river. The mountain is a detached peak, rounded in shape, and about

one mile in diameter. It is situated, principally, in S. 34, T. 2, R. 2, W., and has an elevation of 300 to 400 feet above the surrounding country. Considerably more than half of this height consists of the lower limestones of this formation with their capping sandstone.

In the southeastern quarter of the county, east of the Huntsville Mountain, this intermediate seam of sandstone, though generally seen near the foot of the mountains extending out a short distance only into the fields and lowlands, is sometimes found covering the low knobs and hills of the lowlands. Locally, it seems to be separated into two layers by a varying thickness of limestone, more or less shaly. The sandstone above the division, being flaggy and fine grained; whilst that below, is coarse, soft and friable, easily weathering into a coarse sand. The knoll on which the grave yard at Vienna is situated, is covered on top with fragments of this thin, flaggy sandstone, whilst the country all around it has a coarse, sandy soil, probably resulting from the disintegration of the lower coarse grained sandstones.

Along the southern side of the mountain, bordering upon the Tennessee and in S. 17, T. 5, R. 3, E., and Ss. 28 and 34, T. 4, R. 2, E., this sandstone was seen along the foot of the mountains extending a short distance out into the fields.

Much of the low, flat country northeast of Vienna, and between Keel and Gunter's Mountain, is formed from the lower rocks (below the sandstone) of this formation. These rocks are always near the surface and frequently crop out along level areas; they are light, gray, fossiliferous limestones, containing Pentremites. In S. 20, T. 5, R. 3, E., in a low, flat place, is a cave some twelve or fifteen feet deep, in these rocks, and at Vienna a large spring flows out of a hole, some ten by twenty feet, of unknown depth, surrounded by a grayish blue limestone. The same rocks were also seen along the low, flat bottoms of Flint River, a mile or so from its mouth, and near them numerous, huge sinks, mostly round and dry, and some fifteen feet in depth. The soil

formed from these lower beds is said to be fine for grain, but not for cotton.

Coal Measures—The sandstones and other beds of this formation, cap the higher mountains in the eastern half of the county and to their protection is due the great elevation of these mountains, (1500 to 1600 feet above tide water. The point of greatest elevation, judging from appearances, is a peak of the Huntsville mountains, about two miles east of Whitesburg. In this peak these rocks, doubtless, have a thickness of two hundred feet. The seams of coal are very irregular as to their thickness, in one place thinning down to a few inches, and in another thickening out to about two feet. In McKinney Mountain, (that portion of the Huntsville Mountain, between Flint River and Paint Rock River, there are several seams of coal which are supposed to have an average thickness of twelve to fourteen inches. The coal on Keel Mountain which shows in many places, is about eighteen inches thick. This mountain has the usual line of cliffs around it, and from around these cliffs a fine grained sandstone is gotten, which is said to answer well as a whetstone. The highest points of the mountains in S. 2, 3, 12, T. 5, R. 2 east and S. 22, 26, 27, T. 4, R. 2 east, all contain coal near their tops.

JACKSON COUNTY.

This county is bounded on the north by the State of Tennessee, on the east by Georgia and DeKalb county, on the south by DeKalb and Marshall counties, and on the west by Marshall and Madison counties. It has an area of about 1115 square miles, or 713,000 acres.

Drainage.—All the streams of this county, like those of Lauderdale, Limestone and Madison, flow directly or indirectly into the Tennessee. The Tennessee entering the county near its northeast corner, flows nearly southwest to the southern boundary, a distance of about fifty miles. In this part of its course it is approximately parallel to the eastern boundary of the county and at an average distance of about eight miles from it.

In this part of the river, are the following islands of considerable size: Long Island, Crow Town Island and Bellefonte Island.

The streams flowing into the Tennessee from the northeast side are, beginning above, Jones', Widow's, Big Crow, Mud, Rosebury and North Sauty Creeks. Of these, the most important is Big Crow Creek, formed by the confluence of Little Crow, Big and Little Raccoon Creeks. Little Crow and Big Raccoon Creeks both rise in the highlands of Tennessee; the others have their head waters in Alabama.

On the other side of the Tennessee, on Long Island, South Little Raccoon, Riley and South Sauty Creeks. These are all comparatively short streams. South Sauty forms part of the southern boundary of the county.

Paint Rock River flows into the Tennessee beyond the limits of Jackson county, and hence, so far as this county is concerned, may be considered an independent stream. Its

principal tributaries on the west, are Estelle, Larkins, Lick. Dry and Clear Creeks ; those on the east, are Hurricane and Guess Creeks. From the number of the streams given above, it will be seen that the county is well drained; the only marshes or ill-drained areas being in the lowlands near the mouth of the creeks in the southern part of the county.

General Configuration—The surface of this county is much broken, and its scenery correspondingly diversified.

In general terms, it consists of high mountainous tracts, level on top, and separated by narrow valleys with steep slopes.

The anticlinal valley down which the Tennessee River flows, separates the mountainous eastern portion of the county into two parts—Raccoon Mountain on the southeast. and the Cumberland spurs on the northwest.

This valley has an average width of about four miles, the greater part of this area being north of the river, leaving only a narrow strip on the other side.

The edge of the valley on the north side is very irregular; deeply indented by coves of nearly level fertile land. These coves, cut back into the highlands, have formed gaps in the northern rim of the valley, and produced a row of hills (sometimes several rows) called river hills, running approximately parallel to the river, and lying between the true river bottom, and the higher level areas away from the river. Near the river where denudation has produced its greatest effects, those parts of the highlands, already mentioned as separating the coves, have in many instances been cut across by side ravines, and in this way, more or less completely separated from the main body of the Cumberland table lands. The river hills are usually of this character.

Further back, and generally north of the line of the Memphis and Charleston Railroad, it is usual to find the summits of the highlands lying between the water courses, continuous with that of the great Cumberland plateau of Tennessee.

A line of cliffs near the summit makes the ascent of these spurs exceedingly difficult, and in this part of the county, it is possible to cross these ridges, only by making wide detours, following the courses of the streams, ascending the plateau near their head waters, crossing the level areas on these summits and making the descent along a parallel water course.

South of the Tennessee, Raccoon Mountain faces the river with a line of cliffs almost continuous throughout its entire length, leaving a narrow strip only of bottom land at the base of the mountain.

With this exception, the whole of Jackson county south of the Tennessee is formed by Raccoon Mountain.

Along this line of the cliffs the points are few at which the mountain can be ascended, and the roads usually lead up by gradual slopes, or tortuous zig-zags, cut out along the mountain side. When the top is reached, we find the usual level plateau, very broad in this instance, extending beyond the eastern limits of the county. The monotony of the scenery of this plateau is relieved somewhat by occasional shallow ravines and low places, along which the creeks and spring branches run, and which are sometimes covered with very luxuriant ferns. Where these creeks leave the mountain plateau they have usually cut back into it deep narrow gorges, which present, especially near their heads, many wild and picturesque sights. Standing at the head of one of these defiles, on some prominent, projecting point, one often overlooks a scene well worthy of being portrayed on canvass. The mountain plateaus are from 1800 to 2000 feet above the sea, and from 800 to 1000 feet above the valleys below.

Forests.—The greater part of this county is still covered by its native growth, consisting of oak, pine, cedar, hickory, gum, chestnut, poplar, walnut, etc., the cleared and cultivated lands being confined, principally, to the level and

rolling areas along the Memphis and Charleston Railroad and to the coves, and river and creek bottoms.

Soils.—The soils of this county present about the same varieties as those of Madison, though they are not derived altogether from the same kind of rocks. These soils are comprised within the following general classes:

(1) The red, brown, and black soils, of the mountain and hill sides, of the level and rolling lands, and of the river and creek bottoms. The soils of this class are derived from the disintegration of the rocks of the Mountain Limestone Siliceous groups, and Upper and Lower Silurian formations.

(2) The sandy and light gray siliceous soils, covering some of the creek bottoms and some of the slopes near the foot of the mountains. These soils are formed by the weathering of the sandy seam of the Mountain Limestone and the cherty portions of the Siliceous groups. In this class might also be included the light gray and gravelly soils of the ridges running parallel to Tennessee on the north, and formed from the disintegration of the cherty portions of the Knox Dolomite.

(3) The light and yellowish gray sandy soils covering the level plateaus on the tops of the mountains. Soils of this class are derived from the rocks of the Coal Measures.

No. (1) forms the rich and fertile lands, which are principally in a state of cultivation, and hence are, from an agricultural stand point, the most important. They also rank second as to extent.

No. (2) are of very little importance from any standpoint.

No. (3) are worthy of consideration only from the fact that they cover by far the greater part of the county.

Springs.—This county, like Madison, has many *big springs*. These springs differ from the *big springs* of the counties towards the west, in that the majority of them flow from the rocks of the Mountain Limestone, and are seldom seen boiling up in the low, flat places. They occur along the foot of the mountains and especially near the heads of the deep coves.

They are often accompanied by coves, which sometimes lead back to subterranean lakes. Small springs are found in nearly all parts of the county, and in some localities they are so numerous and so close together as to send off immediately their combined waters in creeks of considerable size. Even along the plateaus covering the tops of the mountains, there are many of these small springs, a good proportion of which are more or less chalybeate. There are sections along the Tennessee river in which good drinking water is not to be had, but everywhere else in the county it seems to be abundant.

Geological Formations.

1. *General Description.*

Of all the counties of North Alabama, this is of the greatest interest geologically, on account of the great variety in the rocks of which its surface is formed.

This variety is in great measure due to the cutting out by erosion, of the anticlinal valley or trough, down which the Tennessee river flows.

The geological formations here exposed, are, in the order of their superposition:

(5) Carboniferous.	Coal Measures.
(4) Sub-Carboniferous.	Mountain Limestone or Chester group. Upper and Lower Siliceous. (St. Louis, and Keokuk groups.
(3) Devonian.	Black Shale.
(2) Upper Silurian.	Clinton or Red Mountain: Dyestone of Tennessee.
(1) Lower Silurian.	Trenton and Nashville. Quebec (Knox) Dolomite.

Quebec or Knox Dolomite—The rocks of this formation in Jackson, consist of blue and gray dolomites and limestones, cherty limestones, and cherty pebbles and nodules. There were also seen associated with these rocks a small quantity of Iron ore, (limonite), Iron conglomerate, and a few small sand

rocks. Some of the massive dolomites and limestones are granular, and others, oolitic; and some of them contain streaks of calcite. These rocks are found in this county only along the anticlinal trough or Tennessee valley. Except in the extreme northern portion of the county, north of Bridgeport and the M. and C. R. R., they occur only on the west side of the river, and not very far from the western limit of the valley.

They are confined to a strip between one and two miles in width, in this valley. The trend of these beds is N. N. E. parallel with the course of the valley except near the north eastern corner of the county where the strike turns more towards the east. The dip is usually at a high angle, either N. W. or S. E., in some cases nearly perpendicular.

The part of the valley formed by these rocks is generally a series of ridges, which are mostly made up of chert and covered with a light gray soil, with angular fragments of chert, and supporting a growth of stunted pines and occasional hickories.

Here, as elsewhere, this is one of the chief iron ore bearing formations and in many parts of the county accumulations of limonite (almost ore banks), are met with.

Near the river these ridges are covered generally with rounded quartz pebbles.

The purer dolomites and limestones of this formation are usually found on the western side of the cherty ridges mentioned.

They are generally covered with a thin coating of soil, and when the soil is nearly wanting, they form rocky knolls, usually covered by a growth of cedar.

Trenton and Nashville—The rocks of these formations are shaly limestones above, and dark blue and dove colored limestones below. The shaly limestones constituting the greater bulk, the blue and dove colored limestones becoming more or less shaly on weathering. All of these rocks are argillaceous, and some of them, especially the shales, sandy.

The shaly portions upon weathering assume an ashy color, and in them ripple marks and *graptolites* are abundant. The dark blue massive variety often contains streaks or thin seams of calcite. These rocks overlie beds of the Knox Dolomite, and like them are inclined, though at not so great an angle. They were observed only immediately along the Tennessee, as a southeast border to the above named cherty ridges, forming principally the narrow bottom of the river, and occasionally low bluffs along the banks. These bluffs usually terminate above in slightly elevated rocky knolls covered with red cedar. Thickness, about 200 feet.

Clinton—These rocks consist of limestones, sandstones, and shales. The limestones are all in thin seams, and more or less shaly and sandy. Many of the seams of shaly and laminated limestones are stained with iron, and are separated along the outcrops, by beds of a deep red loam, which hide the underlying rocks. The sandstones occur principally, as the lower beds of this subdivision, and are of a yellowish gray color, becoming more or less shaly on weathering. The shales are variegated and sandy. The rocks of this formation, as seen in this county, have all considerable dip. They occur only along the anticlinal valley of the east. Their thickness is estimated at about 125 feet.

Black Shale—This formation was observed in one locality only, viz., on the northwest side of the ridge opposite to or east of Bridgeport, between Bridgeport and Raccoon Mountain.

Lower and Upper Siliceous—Westward in Lauderdale, Limestone and Madison counties, these two subdivisions of the Lower Subcarboniferons formation, present usually characteristics by which they can readily be distinguished. In Jackson county, however, these distinctions are to a great extent lost, and the whole Lower Subcarboniferous group becomes siliceous or cherty throughout, and at the same time, considerably thinner than the corresponding beds westward. The two groups, are therefore here considered together.

They consist of impure limestones with chert or hornstone, the chert often forming ridges in the anticlinal valley.

Beyond the limits of this valley they are approximately horizontal in bedding, and form most of the level rolling lands of the county.

As usual, these rocks are characterized by limesinks and ponds.

The thickness, varies greatly in different parts of the county.

Mountain Limestone.—This formation, composed of limestones, sandstones, and shales, occurs principally along the mountain sides, though it sometimes extends down into the valleys. The limestones are blue, gray, and dove-colored, and are usually more or less fossiliferous. Some of the limestones are argillaceous, and contain chert both in thin seams and nodules; other varieties are sparry, others are crinoidal, and others still are oolitic. Some of them are traversed by streaks, or contain cavities of calcite, and occasionally of quartz. The shales are more or less variegated and fossiliferous. The sandstones are both laminated and massive. The laminated portions are fine grained, compact, and hard; the massive varieties are coarse grained, loose, and friable. The beds making up this formation vary very considerably as regards their relative thicknesses, position, and composition. The seam of sandstone appears to be always present, though sometimes near the bottom of the formation; sometimes thin, sometimes in several distinct beds, separated by limestone. The strata have usually very slight, if any, dip. Caves are of frequent occurrence, and from some considerable quantities of nitre have been obtained. The minimum thickness is perhaps about 700 feet thick.

Coal Measures.—These measures, as stated under Madison county, are composed of sandstones, conglomerates, shales, and coal. They are similarly situated to those of Madison, though, in this county, they are of much greater extent both as regards thickness and superficial area. They are the uppermost or newest rocks of the county. They lie on

or above the Mountain Limestone, and form the tops of the broad, plateau-like mountains. These rocks are of importance, principally, on account of their extent, forming about two-thirds of the county, and on account of their being the depository of all the stone coal. In some places this coal occurs in three different seams, one above the other. These seams are separated by sandstones and shales, the lowest seam cropping out usually near the foot of the line of cliffs. The coal of these seams varies very much as to quality and thickness. In some places it is very pure, and in others the reverse; and in some places it is said to be six and seven feet in thickness, whilst in others it is only a few inches. In only two or three places has it been mined to an extent beyond that of supplying the needs of the neighboring blacksmiths. The thickness of this formation in Jackson county is about 200 feet.

2. Details.

Quebec Dolomite (*Knox Dolomite of Tennessee*).—The cherty ridges alluded to above contain the greater part of the rocks of this formation. In some few instances dolomites and limestones of this group were observed in low places where the covering soil had been removed.

Together with the angular fragments of chert (characterized usually, as Prof. Safford has observed, by the presence of rhombohedral cavities), these ridges are partly covered with water-worn pebbles of white quartz.

The ridges, as already stated, are made up of the debris resulting from the disintegration of the cherty limestones or dolomites, where the calcareous portions have been removed, leaving the siliceous fragments in a confused mass, hiding completely any of the bedded rocks which may lie beneath. For this reason exposures of the original strata are not often seen in the ridges.

Below are given some localities where the dolomites and limestones make their appearance: About a quarter of a mile northeast of the steamboat landing, opposite Bridge-

port, across the railroad, a yellowish-gray, hard, cherty limestone occurs. This rock dips southeast at an angle of about 60°, and weathers into a light-grayish shale. About a mile and a half northeast of this locality, a short distance north of Carpenter's station, near the corner of sections 2, 3, 10, and 11, T. 1, R. 9, E., a hard flinty or cherty argillaceous limestone, traversed by streaks of calcite, makes its appearance on the hill-sides and in gullies, some 15 feet thickness exposed. The dip southeast, about 20°.

Near Stevenson, the rocks of this formation appear to lie in close juxtaposition to the Mountain Limestone, as if separated by a fault.

In this vicinity, near Advent Church, a section was obtained showing some of these bedded rocks lying close to the Mountain Limestone.

In S. 14, T. 1, R. 83, the same beds are seen.

Trenton and Nashville of Tennessee Report.—These beds were observed only along the river, southeast of the cherty ridges above mentioned.

About half a mile below Bridgeport, down the river from this station, they form a bluff some 40 feet high on the western bank of the river. The rocks here exposed were buff and dove-colored argillaceous limestones. These rocks are very fossiliferous, containing graptolites, and showing ripple marks in abundance. Along the bluff there were bands of a light and a dark ashy gray color, due to weathering of these rocks into shale. They have a dip of about 25° to southeast. A bluff on the west bank of the river, just below Caperton's Ferry, which is in S. 28, T. 2, R. 8, E., is composed of the following rocks:

Section at Caperton's Ferry.

Nashville and Trenton	(4) A dark blue fossiliferous and argillaceous limestone, forming top of bluff	12	feet.
	(3) Blue massive fossiliferous limestone	5	"
	(2) Same as (4)	8	"
	(1) Dark blue limestone in slabs of three and four inches thick down to water's edge. This rock contains the fossils, *Graptolites*, and also ripple marks	6	"

The same were also seen out in the field, on the west side of the river. West of them and underlying them, a light yellowish gray granular limestone crops out. This last rock forms a low knoll in the field. The dip of these rocks is about 25° to southeast. In the bluff forming the west bank of the river just above Larkin's Ferry, and on the side of the high hill just west of the ferry, the following rocks were seen:

Section at Larkin's Ferry.

Nashville and Trenton	(5) A hard compact argillaceous sandy limestone with divisions of a variegated siliceous shale. Some of the limestone is also variegated. The shale is of a gray, white and red colors......	90 feet.
	(4) A dull blue shaly and laminated limestone occuring in ledges...	50 "
	(3) A hard argillaceous ferruginous limestone	15 "
	(2) A grayish and deep blue massive and compact limestone, becoming shaly in places, on weathering. It is also argillaceous in spots..........................	40 "
	(1) A deep blue laminated limestone.	8 "

The strata of the above section have a dip of 10° to 15° to the southeast The bluff is made up of the beds No. (5) with the exception of about ten feet at the base, formed of No. (4) which extends down to the water's edge.

The full thickness of No. (4) is shown in a hill just west of the ferry. On the eastern or river side of this hill, the bedded rocks are generally hidden by a mass of chert and pebbles, but along the road on the western slope, this bed is crossed, together with chert ridges and other characteristics of the underlying Quebec Dolomite.

The river at this ferry is quite wide, and on the eastern side there are no exposures of rocks, as the low level fertile lands extend out to the foot of the mountain.

Clinton—These rocks crop out near the edges of the anticlinal valley; but sections were obtained only in one or two localities.

On the northwestern side of the ridge, across the river and valley from Bridgeport, the following section was obtained:

Section opposite Bridgeport.

Siliceous	(16)	Loose fossiliferous chert covering top and southeastern side of ridge, with thin seams of chert cropping out near the top on the northwestern side	35 feet.
Black Shale	(15)	Decomposed shale	6 "
	(14)	Thin seams of chert, two inches thick, separated by shale	2 "
Clinton	(13)	A dirty or ashy gray colored sandy limestone in slabs of two inches thickness separated by shale	8 "
	(12)	A reddish argillaceous sandy limestone intermixed with shale	15 "
	(11)	Deep red loam covering the bedded rocks	20 "
	(10)	A variegated, very fossiliferous limestone	4 "
	(9)	Same as (11)	5 "
	(8)	A dark gray sandstone with small red flakes	1 "
	(7)	Same as (11) and (9)	5 "
	(6)	A shaly, light dove colored fossiliferous limestone, showing only	1 "
	(5)	Same as (11), (9) and (7)	6 "
	(4)	A bluff of a yellowish gray sandstone becoming a little shaly on exposure	15 "
Nashville	(3)	Deep blue, dove colored and ashy, massive limestones. These limestones are very fossiliferous and seem to become a little shaly on weathering. The deep blue variety is somewhat argillaceous and contains streaks of calcite	15 "
	(2)	Bedded rocks, covered by soil	15 "
	(1)	Dark blue massive limestone to bottom of section	

The average dip of the beds in the preceding section is 15° to the southeast.

The ridge formed of the rocks of this section, is separated from Raccoon Mountain, by a deep narrow trough-like valvey, holding the calcareous rocks of the Sub-Carboniferous, formation. This valley follows the escarpment of Raccoon Mountain the entire length of the county.

About a mile and a quarter southeast of Scottsboro on the southwest side of *Back-bone Ridge*, (so called from a seam or back-bone of chert which runs along the top,) some fragments were observed of an impure iron ore imbedded in deep red loam, which was probably of this formation.

Black Shale.—In the last section above, is recorded one of the few exposures observed of this group.

In the chert ridges occurring on each side of the Anticlinal Valley, and formed of the Clinton, Black Shale and Siliceous group of the Sub-Carboniferous, the Shale, being softer and more easily denuded than the other beds, seldom appears on the surface.

Lower and Upper Siliceous.—On the chert ridges above mentioned, into the composition of which this formation enters, angular fragments of chert, usually more or less fossiliferous cover the sides of the ridges next to the Coal Measures.

Thus these chert fragments cover the northwestern side of the ridge, bordering on the west or northwest side, the anticlinal valley, in the southern portion of the county, and known as the Back-bone ridge; they also cover the southeastern side, which is the slanting side, of the ridge bordering the above valley on the east in the northeastern portion of the county. Both of the above ridges run northeast and southwest, and have the chert in beds or seams near their tops. The seam along the top of the western or *Back-bone* ridge, is almost perpendicular, or dips a little to the northwest whilst those which occur near the top of the eastern ridge, dip only 15° to southeast. The rocks of these formations are seen as a nar-

row belt, generally, all along the southeastern edge of the anticlinal valley, or along the foot of Raccoon Mountain, occasionally spreading out and forming fine bodies of land, (second bottom lands,) as is the case between the mouths of South Little Raccoon and Long Islands Creeks. Mrs. R. F. Hunter. who lives near the mouth of South Little Raccoon Creek, in S. 19, T. 3, R. 8 E. has in her collection, some fine specimens of the large coral Lithostrotion Canadense found in the upper rocks of this formation. In a cultivated field belonging to this farm, an earthern ware jar, containing a human skeleton has been plowed up. This field forms a part of one of those fine bodies of land above spoken of, as derived from this formation.

These rocks, south of the river, are limited to the above named narrow belt. North of the river, they are not so contracted, forming for the most part the large tracts of level and rolling lands between the mountain spurs of the southern portion of the county, and also the long narrow valleys which extend up the creeks almost to their heads. In S. 7. T. 4, R. 5 E., there is a deep oval basin, of a hundred acres or more, which extends down into the upper rocks of these formations. This basin is completely surrounded by mountain spurs, made up of the overlying formations, leaving no outlet above ground, for the waters falling in the basin. This water disappears or flows off through several sink holes in the southern portion of the basin, and hence this area is known as *the sinks*. These sink holes are believed to be connected with the blowing cave, near the foot of the incline from the coal mines of the Elkmont Coal and Railroad Company, and from which they are separated only by a dividing ridge. In this cave, there is said to be a stream of running water, which flows from the mouth of the cave only during wet seasons. In the western portion of the county, there are two narrow oblong basins, the waters of which escape by subterranean passages like that of the one just mentioned, and hence they, too, are known as *sinks*. These two basins are

on a line with each other and with the valley of Dry Creek, and hence they might be termed merely an extension of this valley. They are divided from each other, and from the valley proper (of Dry Creek), by cross ridges. On the southern side of the lower (furthest south) of these ridges is a bluff at which ends the valley of Dry Creek.

At the base of this bluff is a cave known as the "Mouth of the Sinks" for the reason that during freshets, the water which disappears in the sinks above, emerges here.

At this place was obtained the following:

Section of bluff over Mouth of the Sinks.

Siliceous.	(3)	Light gray cherty limestone............	50 ft.
	(2)	An argillaceous cherty limestone becoming dark on weathering...........	8 "
	(1)	Same as (3). This is the rock in which the opening or cave occurs..............	4 "

The top of this bluff is perhaps 100 ft. below the crest of the crossing ridge.

Mountain Limestone.—Of the rocks of this county these are next in extent to those of the Coal Measures and are of the greatest thickness. It has already been said that they vary very much as to altitude, relative position, and comparative thickness and composition, and, in the absence of detailed sections, nothing more need be added to the general description already given.

Coal Measures.—With the exception of the narrow valleys along the creeks these rocks make up practically the upper or northern two-thirds part of the county. In the southern portion of the county, though forming a very prominent feature, occupying the tops of the mountains and the highest ridges and peaks, they are separated by numerous caves and extensive tracts of low, level, and rolling lands, derived from rocks of lower formations. They form more or less level areas, and terminate along their edges overlooking the valleys, in steep escarpments. In these escarpments, usually

from 30 to 60 feet of the thickness of these rocks are exposed in perpendicular cliffs.

Split Rock Mountain, in the southwest, is said to be the highest mountain in the county. It is about one and a half miles long from north to south, and one and a fourth miles broad from east to west. It is, of course, capped by the rocks of this formation, and is said to contain a seam of coal 18 inches in thickness. The broad, flat mountain, just north of the M. and C. R. R., and between Paint Rock River on the west and Mud Creek on the east, has many high spurs branching off from it, and separated by deep coves. These deep coves, when running in from opposite sides, sometimes almost meet, and form what are known as *the narrows*. From the precipitous heights of these narrows, grand views can be had of the wild scenery near the head of the coves, and of the picturesque valley in the distance, 1,000 feet below. This mountain is covered with much fine timber of oak, hickory and chestnut, and shows numerous out-croppings of coal, especially along the foot of the bordering cliff. The coal varies in thickness from a few inches to about three feet. It is now being extensively worked by the Elkmont Coal and R. R. Co., in that portion of the mountain just north of Boyd's Switch. This company has a broad gauge railroad, about three miles long, running out to the foot of the incline, and connecting with the M. and C. R. R., at Boyd's Switch. It has also a narrow gauge railway, two or three miles long, running from the head of the incline or drum along a bench of the mountain to the different openings or mines. These openings are drifts, and are arranged along the narrow gauge road. At the time visited, they were at work in nine of these drifts.

This company not only furnishes with coal the M. and C. R. R. Co., and, to a great extent, the smaller cities on its line, but also ships a great deal to Memphis, and other large cities. It is a hard, free burning coal, and bears transportation well. The bluff above the coal seam is about 40 feet

high. Tne coal has just above it a sandy shale, and just below it a laminated sandstone, the slabs from six to eight inches thick. The mountain, which is north or northeast of Stevenson, bordering the anticlinal valley on the west, has a seam of coal in it, which is said to be between two and three feet in thickness. This seam has a slight dip to the northwest, and is the one which the Huntsville Mining and Manufacturing Company had commenced to work just previons to the war. This company had built a tramway to their mines, connecting with the M. and C. R. R., at Bolivar Switch.

Raccoon Mountain, south of the Tennessee River, is from 15 to 20 miles broad, and shows frequent out-croppings of coal near the foot of the cliffs, running along the edge of the mountain next to the river. In S. 8, T. 3, R. 8, east, there is a seam of coal which is said to average 4 feet 6 inches in thickness. It was formerly worked by the Capertons, hauled down in wagons to the river, and shipped on flatboats to Chattanooga, etc. This mountain also shows in some places several seams of coal, one above the other. The following section was taken in S. 4, T. 4, R. 8, east, along Little Rocky Branch:

Section Along Little Rock Branch:

		feet,	inches.
(13)	Sandstone to lelvel plateau above.....	30	0
(12)	Shale....................................	2	0
(11)	Coal....................................	1	0
(10)	Fire clay..................................	1	6
(9)	Sandstone and shale........................	20	0
(8)	Coal..	0	10
(7)	Sandstone, cliff rock........................	50	0
(6)	Coal..	1	6
(5)	Shale..	0	6
(4)	Slaty coal....................................	10	0
(3)	Slate..		
(2)	Sandstone....................................		
(1)	Mountain limestone.........................		

No. (11) occurs on the side of the hill, some ten feet above the bed of the branch, and about one mile above the falls of the creek. No. (8) occurs along the bed of the branch about half way between No. (11) and the top of the cliff. No. (6) occurs in a rock-house just at foot of clif. Nos. (11) and (6) have been worked considerably by the neighboring blacksmiths, the coal from No. (6) having been carried on the back in baskets and bags, up a rickety ladder to the plateau above. No. (5) forms the floor of the rock-house, and on account of loose rock, its thickness could not be determined. No. (2) extends about half way down the mountain. Little Rock branch as it makes a clear leap of some thirty-five feet, presents a beautiful sight to an observer at the foot of the cliff.

The water here falls into the deep gorge excavated by South Little Raccoon Creek.

The gorge itself, with huge blocks of conglomerate and sandstone, as large as ordinary cabins, strewn along its sides, viewed from some of the lofty heights bordering upon it, is a wild and picturesque scene.

Coal will doubtless be found in all parts of the county in the positions given in the preceding section on Little Rocky Branch.

In the localities enumerated below, outcrops of coal were either observed by me, or were reported as occurring by reliable persons:

Section	27,	Township	2,	Range	3,	East.
"	3,	"	3,	"	3,	"
"	19, 23, 24, 26,	"	4,	"	3,	"
"	16, 32,	"	1,	"	5,	"
"	5, 8, 19,	"	2,	"	6,	"
"	28, 29,	"	4,	"	7,	"
"	4,	"	4,	"	8,	"
"	8,	"	3,	"	8,	"
"	1, 2, 29, 32,	"	1,	"	8,	"
"	22,	"	1,	"	9,	"

APPENDIX.

I.

ALTITUDE OF TRACK AT STATIONS

On the Mobile & Ohio Railroad, above mean low tide, Mobile, Ala.

STATIONS.	Miles from Mobile.	ALTITUDE Feet.
Mobile	0	6
Whistler	5	41
Chunchulla	18	78
Beaver Meadow	25.5	136
Citronelle, *summit*	32	333
Citronelle	33	317
Deer Park	43	148
State Line, Ala. and Miss	62.6	256
Buckatunna	70.8	150
Winchester	77.4	165
Waynesboro	82.5	191
Limestone	86.9	....
Shubuta	96.4	197
DeSoto	104.4	210
Quitman	109.1	231
Enterprise	120.1	248
Okatibbee	129.8	....
Meridian	135	336
Marion	140.1	....
Lockhart	146.8	360
Lockhart, *summit*	"	426
Lauderdale	153.3	213
Tamola	158.5	....
Narkeeta	163.7	183
Sucarnochee	168.9	225
Scooba	176.2	193
Wahalak	182.5	187
Shuqulak	188.3	221
Macon	197.8	185
Brooksville	206.1	275
Crawford	211.1	316
Artesia	219.2	244
Mayhew	224.1	213
Tibbee	227	207
West Point	232.5	243
Muldon	241.3	304
Prairie	243.7	311
Egypt	253.8	306
Okalona	261.5	311
Shannon	269.3	249
Verona	274.7	307
Tupelo	279.2	280
Saltillo	287.5	318
Guntown	292.3	386

ALTITUDE OF TRACK—CONTINUED.

STATIONS.	Miles from Mobile.	Altitude, Feet.
Baldwyn	297.4	37[illegible]
Booneville	308.6	511
Booneville, *summit*	"	513
Rienzi	316.7	441
Corinth, Miss	328.8	441
Ramer, Tenn	340.8	416
Grove Hill, Clarke county, six miles from G. Trunk Railroad	....	512

II.

ELEVATIONS AT GRADE LINE

On Mobile & Alabama Grand Trunk Railroad above mean low tide in Mobile Bay.

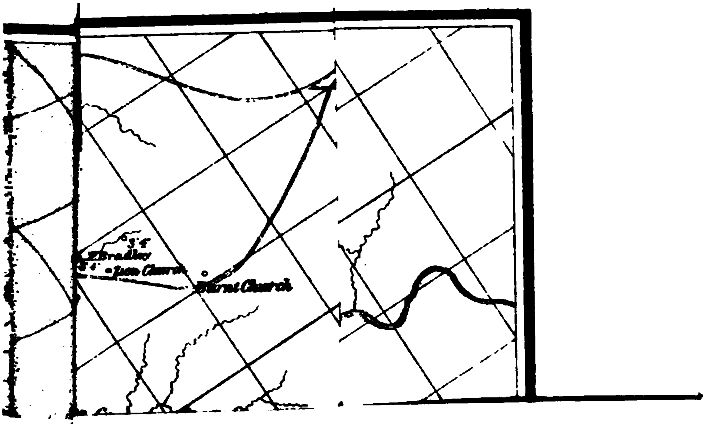
Places on Line.	Distances from Mobile.	Feet Elevation.	Remarks.
Mobile, Beauregard St	0	6	
Plateau Station	3	37	
Cleveland Station	8.7	15	
Creola Station	14	23	
Mount Vernon Station	29	49	
Slade's Station	44	54	
Tombigbee, at bridge	57	42.5	
" height of bank		27	
" river mean low tide		2	
T. 9, R. 4E., S. 29, 3 miles east Grove Hill	81	192	
Summit Grade Head Basset's Creek	94.1	352	T. 11N, R. 3E, S. 25
Hampden, Marengo county	110.25	180.1	
Divide, Alabama and Tombigbee	122.90	190.9	
Ala. Cen. R. R. crossing, Uniontown	138	273.6	
Selma & Greensboro R. R. cross'g. Marion	153	253	
Mount Nebo, Tunnel at Grade	158.6	330	
" " Summit of Mount	158.6	449	T. 20N, R. 7E, S. 24
Old Town Creek, Cahaba Valley	163	195	
West Bank Cahaba, opposite Centreville	183.35	252	
Mouth Shade's Creek	201	319	T. 26N, R. 11E, S. 28
Head Shade's Creek	213.2	485.6	T. 27N, R. 11E, S. 9
Gracie's Gap, Grade	227.5	690	
" " Summit	227.5	716.5	T. 29N, R. 12E, S. 11
Birmingham	232	580	At Grade G.T.R.R.

III. ALTITUDES OF STATIONS

On the Alabama Great Southern Railroad, above Sea Level.

STATIONS.		ALTITUDE	
Chattanooga	(Tenn.)	665	feet.
Wauhatchie	"	671	"
Trenton	(Ga.)	720	"
Dademont	"	813	"
Rising Fawn	"	778	"
Sulphur Springs	"	888	"
Eureka	(Ala.)	960	"
Valley Head	"	1012	"
Holliman's	"	918	"
Fort Payne	"	864	"
Brandon	"	877	"
Collinsville	"	719	"
Greenwood	"	672	"
Reese's	"	580	"
Attalla	"	583	"
Steele's	"	591	"
Whitney	"	594	"
Springville	"	708	"
Trussville	"	683	"
Birmingham	"	577	"
Jonesboro	"	508	"
McCalla	"	466	"
Tannehill	"	466	"
Williams' Cross Roads	"	495	"
Standiford	"	555	"
Greenpond	"	472	"
Woodstock	"	500	"
Vance's	"	495	"
Smallwood's	"	410	"
Clements'	"	400	"
Olmstead	"	269	"
Cottondale	"	254	"
Tuskaloosa	"	162	"
Maxwell's	"	157	"
Hull's	"	122	"
Battle's	"	133	"
Carthage	"	157	"
Stewart's	"	140	"
Akran	"	130	"
Eutaw	"	170	"
Harpville	"	167	"
Boligee	"	104	"
Epes	"	110	"
Brown's Cut	"	225	"
Livingston	"	125	"
York	"	140	"
Cuba	"	200	"
Toomsuba	(Miss.)	276	"
Russell's	"	393	"
Meridian	"	319	"

Altitudes of Stations in *italics* are approximated.


Bradley
Church
Church